

ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LX
JANUARY TO DECEMBER, 1957
NUMBERS 1-6



590.673
A59
v.60-61
1957-58

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ANIMAL KINGDOM

Bulletin of the
New York
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Vol. LX FEBRUARY No. 1 1 9 5 7	

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Choice Still Lies with Man

YES, I admire some of these things—that new computing machine that will do a week's work in a second, the jet plane that tomorrow will take me to the other side of the earth in a few hours, the shovel that will move a hill in a morning, and even the radar beam that we throw against the silent moon. What a man is man! I admire; or perhaps do I wonder, or perhaps do I even dare to question? We, all of us, are living in the age of power, of inventions, of machines. These are of man's creation—can we doubt that they are good? Surely the hands of humanity's clock cannot be turned back.

Out beyond the great massed centers of clustering people and of potent machines lie tranquil lands, silent forests, wild animals in their retreats, mountains towering in seeming watchfulness, rims of oceans brightened by the silent moon. To these glories come many people carried in their machines; their spirits, however, propelled by an innate love that is beyond definition. But so many more never come, nor can they, for they are the imprisoned ones, in duress to that which humanity has created.

We live in an age of many questions but none more searching than those suggested by the above reflections. Will man continue to revere nature? Will he preserve its glories? Will he nurture the productivity of the lands and oceans, the sources of his own life? Or, in the end, will he find his earth desolated, he himself a captive of the forces he has created? The fable of the genii is being retold, yet the choice still lies with man.

Fairfield Osborn

THE SHEEP THAT WAS A LEGEND

By RICHARD G. VAN GELDER

*Assistant Curator, Department of Mammals,
The American Museum of Natural History*

MORE THAN 650 YEARS AGO a teen-aged boy on his way from Venice to China made notes about the people and their habits, the scenery and the animals he saw in the lands through which he passed. Some years later, in a Genoese prison, he dictated the story of his travels to produce the book we now know as "The Travels of Marco Polo." Among the animals that he first described for western eyes were a giant bird, the Roc (of "Arabian Nights" fame), which could carry off a rhinoceros; cattle almost the size of elephants and wild sheep "of a large size, having horns three, four, and even six palms in length." So large were these horns that the natives used them as ladles and vessels for holding food, constructed fences with them and even heaped them into cairns along the roads to guide



travelers when the ground was covered with snow.

For half a millenium Marco Polo's giant sheep was thought to be just another legend like the Roc or the huge cattle, or at best, a goat — probably an ibex. But in 1838 a British Naval officer, Lieutenant Wood, returning from a diplomatic mission, obtained the skulls with horns of two large sheep and sent them to the British Museum. In 1840 Mr. Blyth, a specialist on game animals, recognized the specimens as being the same (presumably) as the animal described by Marco Polo, and before the Zoological Society of London he named the sheep, saying, "I here propose to dedicate the present splendid animal to the illustrious Venetian traveler of the thirteenth century, by the name of *Ovis Polii*" — literally Polo's sheep.

Although Blyth named this sheep a full species, subsequent classification has shown that it is only a subspecies, or geographic race, of the Argali, *Ovis ammon*, and the proper scientific name for the Marco Polo Sheep is now *Ovis ammon polii*. The Argali has a wide distribution in Asia, but that section of the species known as the "*polii* group" seems to be limited to the high country between the headwaters of the Irtysh and the Amu Darya Rivers. The "*polii* group" contains eight subspecies, of which the Marco Polo Sheep is the southwesternmost, being found only on the high Pamir Plateau of Russian Turkestan, near the border of Afghanistan.

Marco Polo's Sheep, or Pamir Argali as it is also called, is the most prized of all game sheep. Although it is not the largest sheep in body size, the males have the longest and widest-spread horns, and the high and hard-to-reach plateau where they live makes them much sought as trophies. The horns of male Pamir Argalis form a loose spiral which may measure more than four feet from tip to tip. An individual horn may be as long as six feet, measured along the outer curve, and may be more than sixteen inches in circumference at the base. The horns form so wide a circle that the ram cannot rest his head

on the ground and can only touch the ground with his muzzle. The horns of the female are shorter, measuring about fifteen inches, and are narrow and only slightly curved. A large male will be three and a half feet high at the shoulder and may weigh three hundred pounds. The upper parts are covered with a light brown hair, darker towards the midline of the back, and the under parts, throat, chest, buttocks, outer surface of the thighs and most of the face are white. In winter the hair is longer and the males get a white ruff on the throat and a dark crest along the back; females lack the white throat and ruff.

Ovis ammon polii is an animal of the high country. Rarely, if ever, do they descend below 10,000 feet, and they have been seen feeding above 18,000 feet. The Pamir Plateau is a rolling plain, and here the ewes of all ages and the young of both sexes graze in large flocks. Ordinarily the adult rams keep to themselves in parties of two to ten, occasionally more, and playfully butt or stab sidewise at one another as they move to and from the feeding grounds. At little patches of grass along the snow lines the sheep feed from early morning until an hour or two before noon. Then they lie down, choosing the drier places, and ruminate until three or four o'clock in the afternoon when they again graze until dark and then bed down for the night. They do not seem to be confident of their footing on snow, and ordinarily they try to avoid snow-filled gullies and drifts. When they must cross such an area, one animal usually leads and tests the footing, and when a safe passage is found, the rest of the flock follows.

In the rarefied atmosphere in which they spend the summer, the sheep move slowly. When pressed and running uphill, they open their mouths as if to breathe more deeply and make frequent stops. At 18,000 feet where these sheep spend the summer, there is about half the oxygen in the atmosphere that there is at sea-level and almost one-fifth less than at the Pamir Argali's winter range at 11,000 feet.

Marco Polo's Sheep breed once a year, in late autumn, and the gestation period is five months. The time of lambing seems to vary considerably in the different subspecies of *Ovis ammon*, and it is most likely that the season of birth is later in those areas which have a more severe climate.

Although it is not the largest sheep in the world, Marco Polo's Sheep has the largest horns. The body weight has been estimated at 500 pounds for a ram; the ewe, with straighter horns, is a little smaller.

Illustration from Lydekker's "Royal Natural History"



The home of the Marco Polo Sheep is in the Russian Pamirs, called "the roof of the world." It is a high, forbidding habitat.

Photo American Museum of Natural History

Diagonal lines show the home of the Argali; cross-hatched lines indicate the much more restricted home of the Marco Polo Sheep.

It is reported that the young ewes have but a single lamb, the older ones ordinarily two.

Life is not easy for the Marco Polo Sheep. In winter, when the snows have forced them from the high meadows to the lower slopes, they are plagued by starvation and preyed upon by wolves. In the spring when the snow melts, decaying carcasses are to be seen by the dozens. Even Marco Polo mentioned that the wolves preyed heavily on these sheep and he, too, found the piles of bones left when the snows were

gone and told how the natives heaped them into cairns to mark the roads. In the summer the wolves are not such a problem to the Pamir Argali, for they can be seen at a greater distance and the sheep can escape more readily, but at this season the sheep are bothered by parasites. Fly larvae burrow beneath the skin of the adults, and may even infest the nose. Ticks attach themselves and gorge on blood, and Marco Polo Sheep have been observed rubbing against rocks, presumably to remove the annoying ticks.

Thus far man does not seem to have affected the life of the Marco Polo Sheep too greatly. The difficulty in reaching their home has limited the number of sportsmen who hunt them, and the natives hunt them mainly in the winter when there is not enough food for all the animals anyway. It has been noted, however, that rams with huge horns of 80 or more inches are no longer to



be found, and this probably can be attributed to the sportsmen. Thirty years ago as many as fifteen hundred sheep could be observed in a month on the Pamir Plateau; sixty years ago as many as 600 head were seen in a single day. No information seems to be available concerning their present status, but it seems likely that as the natives obtain modern firearms, without hunting restrictions, the numbers of these magnificent sheep will be greatly reduced. In some parts of their range the animals have already moved to

the wilder, more inaccessible sections where they are less likely to be persecuted by man.

Perhaps the greatest decrease in numbers of Marco Polo's Sheep was caused indirectly by man. In the winter of 1897-1898 rinderpest (cattle plague) infected the flocks in the Pamir region and sheep died by the hundreds. In some districts almost every animal may have succumbed. The disease was undoubtedly contracted from the domestic stock of the natives.

When they first notice the presence of a man, usually seen at 200 to 300 yards, the sheep all face him and crowd together, stamping the ground with the forefeet and sometimes even approaching him. Suddenly one will turn and run, and in a flash the entire flock follows. But after running a few hundred yards they will often turn and stop for another look, and then turn and run again and stop. When galloping the males carry

the head erect, rather than outstretched, probably because of the great weight of the horns.

Because of the inaccessibility of their home, it has been difficult to obtain specimens for American zoos. It was not until a year ago that the first live Marco Polo Sheep were received in this country, but last fall, after a month's quarantine, three young sheep, two females and a male, came to the Bronx Zoo. Their new home is in a spacious and rocky enclosure north of the Antelope House, where it is hoped that in a few years the male will develop the magnificent horns that made such an impression on Marco Polo (and everyone else who has seen them) 650 years ago.

Typically, the young male of our trio of Marco Polo Sheep is down at the right, almost out of the picture. The two females, being older and larger, usually drive him to the background.





The Amphibious Dipper

By WILLIAM G. CONWAY

A GRAYISH BLUR, a shrill zeet!, a splash. A few moments later a chunky, slate-colored bird broke the surface of a swiftly-tumbling stream in a Rocky Mountain canyon and stood on a rock to preen, with occasional bobbing dips like haphazard punctuation. This was my introduction to the dipper, or Water Ouzel, in its remote mountain home, a stream some ten to thirty feet wide that varied from a rushing boulder-strewn torrent to a gentle and meandering brook, and from white-water cascades to transparent and marble-surfaced side pools.

With a view toward gaining information which might some day be used in designing a display of Water Ouzels in the Zoological Park,

I had inquired about the best dipper haunts in the Pike's Peak region of central Colorado. Eleven Mile Canyon, thirty-five miles west of Pike's Peak at an elevation of some 8,000 feet, was suggested as the most likely hunting grounds for a day's ouzel quest in September. And it was, indeed, a good one.

Even as I watched, the dipper casually tightened his feathers and walked into and *under* the water. A dipper's plumage is unusually thick and dense and its nostrils can be covered by a movable scale. I knew this — but, still, the sight of a small bird calmly striding under water is enough to startle anyone the first time he sees it. It is no less surprising when the bird bobs to the

surface and turns about like a waterlogged phalarope, obviously almost dry despite a walk under water—and then to see it squat in a shallow pool and go about the business of bathing like any ordinary dry land avian! Seeing this, it is still some minutes before you remember that the oil gland, so very important in water-resistant feather dressing in waterfowl, is much larger in dippers than in related land birds of comparable size.

Five species of dipper are recognized, two in Europe and Asia, one in North America and two in South America. Believed to be of American origin, they are one of those New World families which may at one time have crossed the so-called Bering Strait land bridge to the Old World, along

dipper is tied to a certain environment more strictly than any captain to his ship. Probably the greatest hazard future dipper populations will have to face is increasing stream pollution from mills and mines. “Free as a bird” is an expression which rarely bears close scrutiny in regard to animals, and the dipper is no exception. Its food-seeking and reproductive behavior are tied to its habitat, and as the mountain streams go, so goes the dipper.

Even the flight of the dipper is adapted to its tortuously twisting mountain streams. As John Muir puts it, in his lovely ouzel chronicle: “The vertical curves and angles of the most precipitous torrents he traces with the same rigid fidelity,



Looking not at all like the kind of bird that ought to go in the water except to take a bath, the Water Ouzel nevertheless is completely at home in swiftly flowing streams and in quiet pools. In the center photograph, it is tails-up, just beginning a dive.

Photographs by the Author

with other groups such as wrens and buntings. Ouzels seem to be more closely related to wrens than anything else.

The dipper I was watching in that mountain stream is known as *Cinclus mexicanus unicolor*. Although it is not migratory, it may move downstream a little way toward less severe weather in winter, but it is capable of withstanding great cold and stays in its “summer home” as long as there is open water. Its over-all range is large, along the mountains of western North America from northern Alaska and western Canada south to southern Mexico.

Its ecologic niche is a rigorous one, and the



swooping down the inclines of the cascades, dropping sheer over dizzy falls amid the spray . . .” That is exactly how my ouzel flew, and my enthusiasm for finding a way to exhibit the bird in a zoological collection grew stronger as I watched — for it is reasonably easy to envision a Bird House complete with a Rocky Mountain stream and even an aquarium-like under-water view.

Peering through the surface reflections of the dipper’s hunting grounds, I could see the stubby form, now sleek and streamlined under water, searching intently around the pebbles and debris of a clear pool. From time to time, bobbing to the surface like a bubble in a champagne glass, the dipper would paddle to a near shore or rock holding a caddis fly larva in its bill, place the insect on the ground and peck it to edible pieces. Whether the dipper swallows any of its gleanings under water is a disputed point, but anyone who has ever attempted to extract a caddis fly larva from its little fortress must have admiration for the way a dipper accomplishes this with ease under water.

The bird’s ability to stay submerged seems to vary with its observer. Unlikely times, up to three minutes, have been implied. But in more than fifty measurements on a dozen birds, the longest submersion I was able to record was 21 seconds. It is not unreasonable to guess that a dipper might double this time if it really had a good reason for doing so.

Ouzels have occasionally been condemned by fishermen for eating fish fry and spawn. While these probably form a good part of their regimen at certain times in a few places, the scattered and territory-minded dipper population would certainly not commit any considerable depredations under natural conditions. Aquatic insects and larvae seem to make up most of its bill of fare.

Under swift water the dipper always appears to face into the current, orienting its body with tail high and head down while searching for food. This arrangement, with the inclined back acting as a foil, enables the bird to utilize the water current and pressure to maintain its grip on the stream bottom and avoid being swept backwards with the flow. I saw no dippers walk *downstream* under water and it is hard to imagine how they could maintain their preferred “bottoms up” position if they did so. Some observers report

that dippers swim primarily with their powerful wings, literally flying under water. Others have asserted that the feet are the primary propulsive members. Limited time and unlimited water-reflections left the matter in doubt in my mind, but I find it hard to believe that the dipper can travel such amazing underwater distances, with such remarkable speed, using only its slender and webless feet.

Although my visit was favored by only a poor sampling of refined “sneezes” and shrill call notes, the American dipper’s song is famous for its sparkling radiance. Muir’s marvellous prose cannot be improved upon: “The more striking strains are perfect arabesques of melody, composed of a few full round mellow notes, embroidered with delicate trills which fade and melt in long slender cadences. In a general way his music is that of the streams refined and spiritualized. The deep booming notes of the falls are in it, the trills of rapids, the gurgling of margin eddies, the low whispering of level reaches, and the sweet tinkle of separate drops oozing from the ends of mosses and falling into tranquil pools.”

The nest of the dipper is as unusual as its behavior. Round and about a foot in diameter, with a side entrance, almost the whole structure is built of mosses. Usually it is placed on a ledge or in a crevice of a cliff bordering the dipper’s stream, and it blends beautifully with the natural moss-and-fern blanket of the rocks. The spray from falls and cascades keeps it fresh and green. In recent years, supports under bridges have often been reported as ouzel nesting sites. Usually four or five eggs form a clutch, and two broods may be reared during the season in the southerly part of the bird’s range.

The Zoological Society has exhibited only one dipper, a specimen received from Charles Cordier in the spring of 1952. This White-backed Dipper, *Cinclus leucocephalus leuconotus* Sclater, was the form that ranges from Ecuador to Venezuela and is more strikingly-patterned than our native one. It adorned our collection for several months, and since its death no more have been offered. But some day they will be offered, or we will send our own expedition into their mountain fastnesses, for birds with such strange habits and specializations — difficult though these make them — are real avicultural challenges.

GRUNT, MY WILD BOAR

By MARGARET ALTMANN

Moose & Elk Researcher, Jackson Hole Biological Research Station

IN MY TEENS I had hunted the wild boar on moonlit nights from blinds in the potato fields or snow-covered woods of the Baltic provinces of Germany. Then after a long interval, I returned to Europe to examine the social life of this aggressive game.

When I reached the big beech-and-oak forests of the old Lippe Dukedom in Western Germany,

the group. The wild hogs, although excitable and aggressive among their own group, definitely help each other out and defend the young against any intruder.

The striped little wild boar pigs react to the danger grunt of the sow by scattering and lying low, a remarkable disappearance act. If the intruder happens to step on one of the hidden pigs,

Wild swine feeding in a German forest. The alert boar is looking toward the camera, in the center.

Photo: Samhaber, Aschaffenburg



I was told that an increase of damage to field crops by wild boar hordes was noticeable in the last few years. No one knew why this was the case. Was it an influx of wild boars from the none-too-distant iron curtain border?

The "black game," as it is called in Germany, has closely knit family ties. A band consists usually of a litter and its mother. Sometimes there are still a few members of the previous litter in

a tremendous squeal will bring the infuriated sow to instant action. Like a torpedo, she will aim and rarely miss a target. Fear or caution she does not know in such moments.

When peace and quiet lie over the forest thickets, the wild boar clan often gathers in an opening and the pigs play games around the foraging mother. Most games are fighting games in the wild boar manner. Squealing and posturing like



This is Hans, a young wild boar encountered on a forest path.

Photo: Konrad Kurr

big old boars, heads held high, the striped little fellows hit each other with the baby tusks or pretend to do so. Running and rushing is also a favorite part of this game.

Resting and sleeping is done in closest contact with each other. The family group forms a pile and even the boar may be in friendly association with the small pigs. Many of the daylight hours are spent in the thick underbrush. At dawn and dusk, as well as at night, the clan forages in the fields. Root crops, potatoes in particular, are the favorite foods. One wild sow and her family can do considerable damage in a few hours, digging the potatoes efficiently by following the planted row.

The senses of hearing and smelling are very keen in the wild boar, while sight does not play such a role because of the thick underbrush and cover in which the animals spend most of their lives.

The daily range of the bands is considerable. They may travel four to seven miles for feeding or upon even a minor disturbance, and may leave a whole area for good when hunting pressure begins.

It is no wonder that the wild boar is considered among the wildest of game animals. Nevertheless, there are exceptional individuals even in wild boars. This is the case history of Grunzo, a wild sow, as I witnessed it while staying at the forestry station in West Germany with my ranger (forester) friends.

Grunzo had been picked up by a truck driver at night on a roadside in the deep forest of the Lippe-Westfalian districts. The forester's kind family raised the striped little squealer — first, bottle fed, later released back of the ranger sta-

tion. They named the little wild pig "Grunzo" and gladly gave her a handout of boiled potatoes and grain when she visited the yard.

Grunzo soon lived entirely in the forest, but kept some privileges in the ranger station. She had learned, for instance, to open doors and, to the distress of the neat grandmother in the ranger's family, she intruded in the milk house to raid the milk and cream pots, upsetting all pots and leaving a considerable mess. Months went by. One day, early in December, Grunzo stood in the yard of the ranger station while the rangers piled a load of fresh straw and hay into the hayshed.

A few days later, Grunzo had moved into the hayshed to bear her first litter. Unfortunately, one of the little pigs fell through the slats of the crude shed into the dog kennel, and was killed by the dogs despite Grunzo's brave efforts to rescue it. She bit the slats till her gums were bleeding, but to no avail. That same evening, in a bad snowstorm, Grunzo gathered her tiny litter and left the ranger station for the wintry forest. No one expected any of the pigs to survive the fury of the cold and snow. But, three days later, Grunzo brought them back, moved into the shed, and went on to successfully rear the rest of the litter.

One day in spring, Grunzo opened the door of a shed at the station and found a bag of grain on one of the shelves. It was poisoned grain for rodent control, and she died within two hours. But her wild pigs were saved and are still around the station, running free. When I was there last winter, they would follow me into the forest in the evening, and if I scratched the bristly back of one of them, the others would get jealous and start a rush to be scratched, too.



It Makes a Career of Eating Mosquitoes

By DONN E. ROSEN

Genetics Laboratory, New York Aquarium

Gambusia is not the only answer to the world's mosquito problem, but in the right time and place it is a valuable adjunct of mechanical and chemical control measures. This is a pair.

IT CANNOT BE TAKEN FOR GRANTED that where there are catfish, there are also cats. Neither do dogfish imply the presence of dogs. But mosquitofish and mosquitoes *do* go together, or have been brought together purposely, in more than a dozen states of the United States and in more than three-score countries, islands and dependencies all over the world. As a devourer of mosquito larvae, and therefore as an agent in the control of malaria, the mosquitofish has few if any equals.

The fish I mean when I speak of "mosquito-fish" is any one of the two dozen or more species and subspecies of *Gambusia* — particularly *Gambusia affinis*, the common *Gambusia* of the southeastern United States. Actually a number of quite unrelated fish are popularly known as mosquitofish — the guppy, heterandria, the sunfish, the goldfish, the sailfin mollie, and many other familiar freshwater minnows. They are all good

mosquito-eaters, but none can touch *Gambusia* in that department. Under certain conditions it almost, you might say, makes a career of devouring mosquito larvae.

Gambusia is not, however, the sole and self-sufficient answer to the world's mosquito problem. There are some situations that even *Gambusia* cannot cure and scarcely can alleviate. I ran into one of them some time ago in the Bahamas, when we were working out of the Lerner Marine Laboratory of the American Museum of Natural History on North Bimini.

Much of the shoreline of the three major islands — North, South and East Bimini — has been built up gradually with the aid of two very hardy plants that can live and flourish in salt water, the red and black mangroves. By sending out twisting and branching networks of roots into the water, they establish tangles and tunnels that almost defy imagination. On the northwest corner of South Bimini, mangrove thickets have spread to enclose a rather broad and open salt water pond connected to the main lagoon by a narrow channel, which at low tide is choked by emerging vegetation and is all but impassable. Other narrow lanes in the mangrove tangle extend a few

hundred feet into the adjacent swamps and here, again, at low tide the black, slimy, fetid complex of roots is exposed. The pond swarms with *Gambusias*, which I was trying to collect for various purposes, and the job was made no easier by the fish's habit of taking refuge among the mangrove roots when frightened.

There were, as I said, plenty of mosquitofish in the pond. In two seine hauls we lifted out more than five hundred. Cautious, careful maneuvering of the seine and the beaters made it possible to round up a thousand fish in a very few minutes. Unfortunately, just before we finished the day's stint, the wind shifted and what I can only describe as a cloud of mosquitoes drifted toward us. One of the beaters was bent over, intent on the approaching school of fish, when the swarm hit him — right where his thin cotton pants were stretched tightest. He yelped and jerked upright, but the rest of us had no time to laugh at his discomfort, for in another moment we were enveloped, too.

Here, then, was a place in which the fish that feeds on mosquitoes was (to say the least) doing a very poor job of keeping down the mosquito population. Why?

It is a good question. Many years ago one of our most famous ichthyologists, Samuel F. Hildebrand, noticed that many common aquatic and semi-aquatic plants provide conditions favorable for the propagation of mosquitoes. Many of them, moreover, are so dense and extend so far into the water that they are an effective barrier against most fishes. The mangrove forms such a barrier, beyond the first few feet of roots where the *Gambusias* take sanctuary from predators. That is at least part of the explanation of the failure of the mosquitofish to keep down the plague of mosquitoes in Bimini.

The *Gambusia* we collected in Bimini has not yet been named, but it does very closely resemble two species named from other Bahaman islands, *Gambusia hubbsi* and *Gambusia manni*. All have steel-blue sides overlying a dark olive ground color, sometimes flecked with tiny black dots. Their dorsal fins are brilliant orange in nature, but this color fades to bright yellow if the fish are transferred from salt to fresh water. As is usual with most but not all live-bearers, the females are rather drab by comparison with the

males, but they do retain some of the iridescent blue on the flanks and a trace of orange on the dorsal fins.

The *Gambusias* are not spectacular enough, I fear, ever to become popular with home aquaria enthusiasts. But the interest they have for professional ichthyologists more than makes up for that.

The reason lies in their hardiness and adaptability. The Bimini *Gambusias*, for instance, swim in sea water that may rise to a temperature of 95° Fahrenheit. They live alongside young barracuda and other predatory fishes and birds, and they successfully withstand daily tidal currents and seasonal hurricanes. And yet *Gambusias* remain among the most prolific, voracious and abundant fishes in the islands where they are found. Chiefly because of their hardiness, these fishes have recently been selected as an experimental animal in the study of human viruses. They are also interesting to ecologists (the biologists who study the complicated interactions of animals, plants, and the physical environment) because of their wide range of tolerances for constantly shifting conditions. The Bimini Gam-

On South Bimini, mangrove thickets have spread to enclose a salt water pond which is swarming with *Gambusias* — and mosquitoes. The mangrove roots are too thick for fish to reach the mosquito larvae.

busia is but one member of this genus that can flourish under really extreme conditions. The common *Gambusia* of the southeastern United States, *Gambusia affinis*, the original and still most widely employed "mosquitofish," and perhaps the one most familiar to aquarists the world over, ranges from the Gulf coastal states northward and eastward, extending its natural territory as far north as southern New Jersey and Illinois. Within this natural range the American Mosquitofish (known also as top-minnow or pussygut) may be found in an almost endless profusion of different and sometimes quite extreme habitats. Picking its way through the torrid swamps of our southern coastal states, or wintering under a layer of ice up north, invading the coastal salt and brackish waters of our estuaries and bays, or running into fresh-water inland streams, inhabiting crystal clear fresh-water lakes and ponds as well

as the foul stagnant water of bogs and swamps, drainage ditches and rain barrels, it flourishes under such extremes. One writer has even reported *Gambusias* living in the extremely foul water of drying borrow pits in Louisiana — holes excavated for the purpose of obtaining fill, which have gradually accumulated water from ground seepage and rain.

It is this surprising toughness, particularly of the American *Gambusia affinis*, coupled with an enormous appetite for almost everything of the right size that wiggles, jumps or swims, that has made these little fishes so famous in mosquito abatement programs. On May 26, 1919, 40 female and 12 male *G. affinis* were introduced into an ornamental pond on the campus of the University of Pennsylvania in which mosquitoes commonly bred during the spring and summer. Part of this pond had been carefully screened off, thus allowing some of the mosquitoes to reproduce unmolested during the course of the experiment. By June 5 the mosquitofish not only had eagerly consumed a large portion of the larval mosquito population but most of the initially more abundant midge larvae and other aquatic organisms as

well. Sampling of the exposed places of the pond at this time showed an average of 2 to 3 mosquito larvae per sample in the pond proper as compared with about 16 in the screened-off area into which the *Gambusias* could not penetrate. On June 18 *Gambusias* could be seen all over the pond and a sample at this time brought forth only 4 mosquito larvae in 30 dips of the sampling device, compared with about 5 larvae per dipper in the check pen, some 20% of which were the malarial mosquito, *Anopheles*. On June 30 conditions in the unscreened portion of the pond were the same, while in the check pen the count had risen to an average of about 14 larvae per sampling. It was estimated at the end of three months that the total fish population derived from the 52 *Gambusias* introduced on May 26 was in the neighborhood of several thousand. In a more recent experiment conducted at the Michigan State Fish Hatchery, the mosquitofish was found to be roughly 81 and 95 per cent effective for two consecutive years in the control of mosquitoes. Once, in connection with a similar study, someone watched a 2 $\frac{1}{3}$ inch female top-minnow consume 225 wiggle-tails in one hour. While this



figure is hardly typical of the majority of mosquitofish, especially the much smaller males and young fishes, it serves to emphasize their potentialities as mosquito-killers.

So successful have these live-bearers proved to be in our own anti-malaria campaigns that in the course of something more than 30 years they have been transplanted to almost every habitable part of the globe with good success.

Amusing circumstances sometimes arise as a result of foreign introductions of mosquitofish on a world-wide scale. Recently one of our museums received a shipment of fishes from the Nile, and unpacked it in anticipation of a collection which might contain some of the more rare and interesting fishes of that region. Inevitably a large proportion of the fishes were the common mosquitofish that occurs naturally only a short distance away in the museum's own state. Equally disappointing was my own experience in getting a small cardboard container of "unusual" fish from the Belgian Congo. As pretty as they are, I sometimes think I could almost hate those pesky *Gambusia affinis*.

In 1952, Mr. E. Thomas Gilliard of the Department of Birds at the American Museum of Natural History went to the mountains and jungles of eastern New Guinea in search of birds of paradise. He returned to New York with a great assortment of animals, many new to science, which was not especially surprising in itself because the area had been virtually unexplored, except for some military operations during the second World War. I had examined some of the fishes collected at about 5,200 feet above sea level 30 miles from the headwaters of the Wahgi River, and identified some of them as our old friend, *G. affinis*. I was further able to pin them down as having derived from one of our native eastern strains, similar in many details to the mosquitofish of Florida's Okefenokee Swamp. Some days later I told Mr. Gilliard of my identification and he appeared both surprised and a little indignant. Then he remarked in his usual good humor that it was bad enough to have collected a fish in the wilds of New Guinea that proved to be a native American, but that it should be one of our more common species and, what's more, from a stock somewhere east of the Mississippi, was adding insult to injury.

After all this ado about the larvicidal properties of the Gambusias, we may refine our explanation of why Gambusias and mosquitoes in some places seemingly live side by side so harmoniously. All told, there are more than two dozen named forms of the genus *Gambusia* native to the United States, Mexico, Central America, the northern tip of South America, the Bahamas, Cuba and many other Caribbean islands. Mosquitoes are a major problem in all of these areas, and we can be reasonably certain that all of the two dozen Gambusias are just as "mosquito crazy" as their northern cousin *Gambusia affinis*, for all of the members of this genus are highly carnivorous. The point of the Bimini anecdote above is that although these little top-minnows abound in all of the Bimini islands and in most of the lesser keys, the special environmental conditions which exist there are such that *the Gambusias cannot easily get to the mosquitoes' breeding grounds or the aquatic juvenile stages in the mosquitoes' life cycle*. This is a very important point and one that is crucial to all the years of research that have gone into adapting these fish as self-perpetuating insecticides.

A slightly different approach has helped to clarify still another of the many problems in our never-ending fight against diseases transmitted by insects with an aquatic juvenile stage somewhere in their life histories. The type of food consumed by a fish such as *Gambusia*, with larvicidal capabilities, is determined to a very large extent by the *availability and relative abundance of the different foods*. Where some insect larvae other than mosquito, or crustaceans such as *Daphnia*, are more common than wiggle-tails, the Gambusias actually "steer clear" and allow the wiggle-tails to become malaria-carrying adults — just as those in the University of Pennsylvania experiment first consumed the other more abundant organisms before they ate the wigglers.

Limitations such as this do not really impair *Gambusia's* usefulness, for where the fish alone fails to produce good control, health inspectors all over the world have learned to supplement it with mechanical and chemical control measures. But there are many situations in which the fish alone is adequate to the job and the continuing introduction of the mosquito-fish into more than 70 foreign lands bespeaks its astonishing success.

ZOO NEWS IN PICTURES

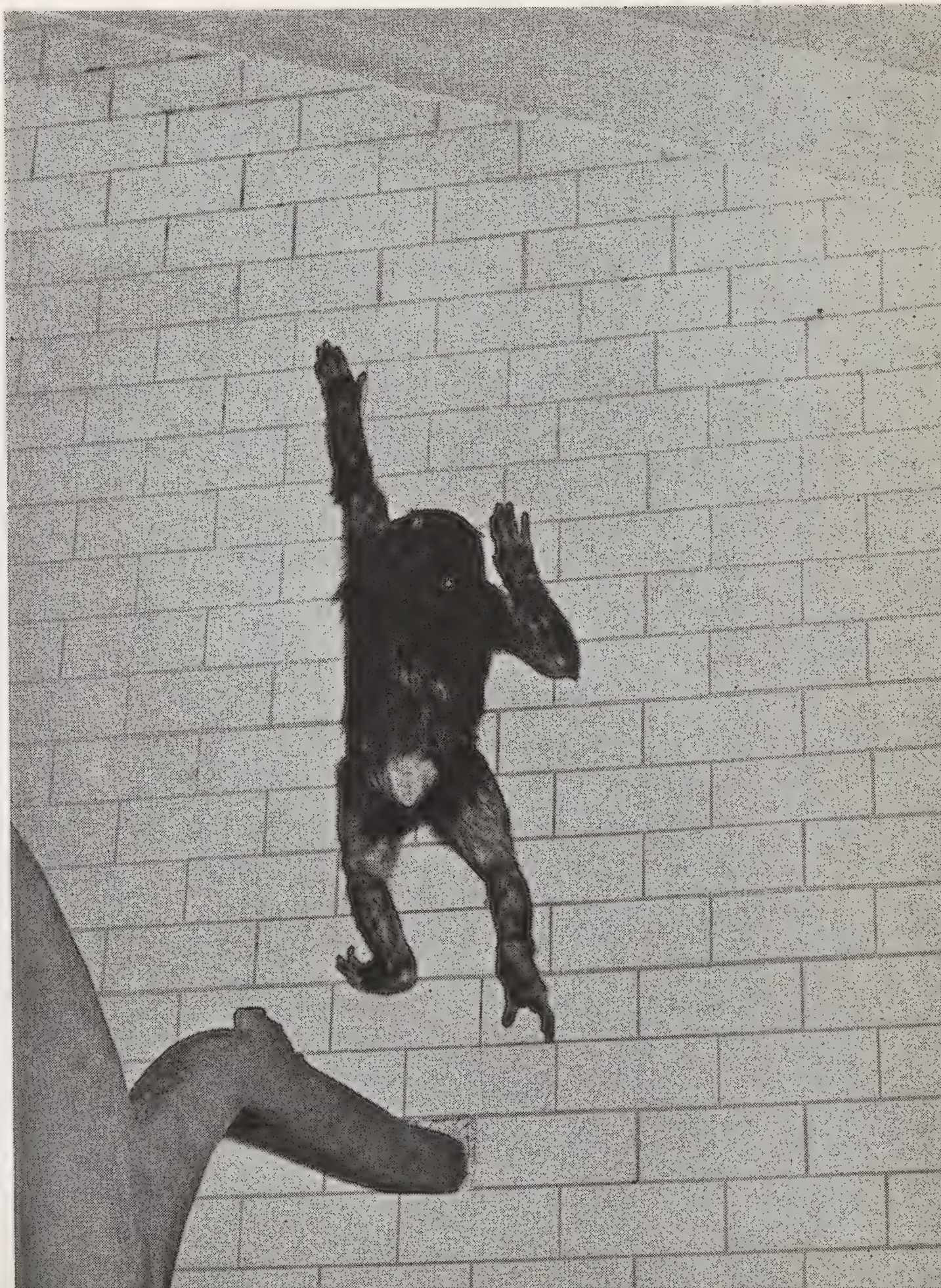
Photographs by
SAM DUNTON

When will he drop his antlers? With the exception of one year, we have a complete record of shedding dates for this magnificent **AMERICAN ELK** that came to the Zoo from the Jackson Hole Wildlife Park in February, 1947. In that year it shed on April 18, but subsequently there has been a fairly regular progression toward an earlier date: March 31, 26, 28, 20, 19, —, 18, 19, 17. It is possible that elk shed earlier as they grow older; this is said to be the case with Moose. One of our Moose in a period of 5 years moved back its shedding from February to November.



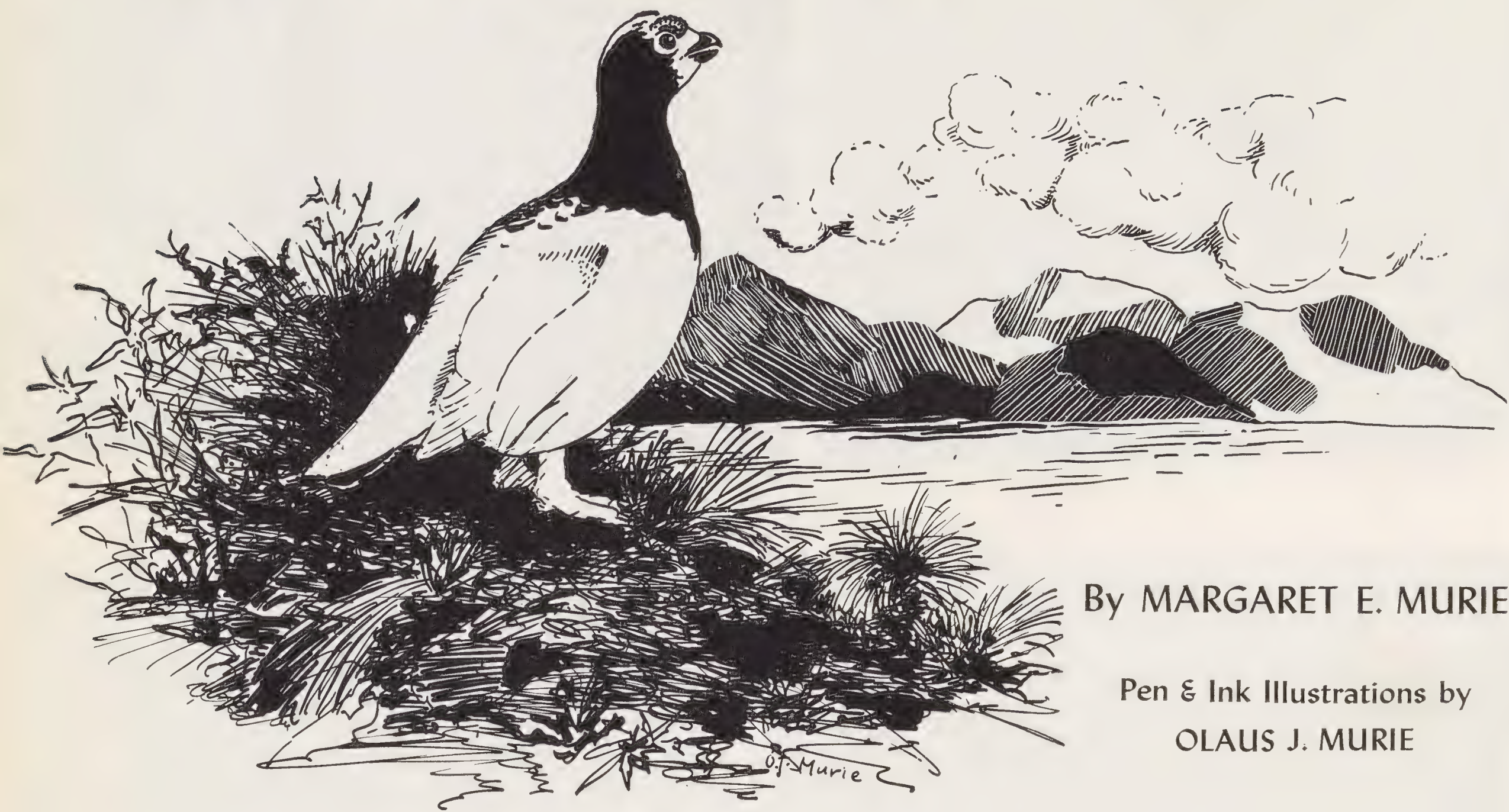
Until this past mid-December, the last time we had exhibited the **LONG-NOSED TENREC** of Madagascar was in the spring of 1914. When a male Tenrec was presented to us on December 17 by James Dolan, a Member of the Zoological Society, we had few hopes of keeping it more than a few hours, for it was obviously half dead, with hardly the energy to stand on its legs. Drs. Goss and Gandal fed it hypodermically with glucose and protein and injected massive doses of multiple vitamins, and then turned it over to Hospital Attendant Waltz with instructions to do his best. As with any good keeper, his best was very good. Tenrecs are said to feed on earthworms, so he scraped under leaves in the frozen forest and collected earthworms, which he buried in a pan of loose dirt to tempt the little animal. He cajoled it into taking a mixture of milk, egg yolk and finely ground meat. Within a week the limp and listless Tenrec was transformed — so lively that these photographs had to be made with a fast electronic flash.





What will a **CHIMPANZEE** do for a piece of pineapple? These three pictures are part of the answer, for they show our "Little Women"—Amy, Jo, Beth and Meg—in the quite improbable areas of their compartment in the Great Apes House that they have managed to reach in their quest for their favorite delicacy hidden there by their keeper. Scaling the slick tile wall at the corner, where it forms a 90-degree angle, is no trick at all; they have been doing that for a couple of years. Recently they have learned to walk across the wall by pushing against a ceiling beam with their hands; one has even had a certain amount of success in jumping and climbing the bare wall, but never reaches the top.

A Week on Lobo



By MARGARET E. MURIE

Pen & Ink Illustrations by
OLAUS J. MURIE

and always-the ptarmigan

THE TERRITORY OF ALASKA contains the last large expanses of untouched wild country in United States possession. With the increase of population everywhere, development of earth-moving and road-building machinery and the growth of military establishments, conservationists have had misgivings about the future of even a small segment of this Alaskan wilderness. The New York Zoological Society and The Conservation Foundation sent Dr. A. Starker Leopold and Dr. F. Fraser Darling to Alaska in 1952 to make observations on the status of wildlife. In May of last year the Society and the Foundation sponsored another expedition, to the Brooks Range, under the leadership of Dr. Olaus J. Murie. Its purpose was to gain intimate knowledge of one area—the Sheenjek country—as a “sample adventure” in wilderness experience, “to help us decide,” as Dr. Murie expressed it, “whether or not the Arctic wilderness is worth fighting for.” The article that follows is Mrs. Murie’s report on the “sample adventure.”

ACROSS ALMOST THE WHOLE TOP of Alaska, back from the flat Arctic coastline some hundred miles, lifts the Brooks Range—a composite of many mountain groupings but forming a continuous great mountain world one hundred miles deep and up to ten thousand feet high—a massive northern rampart to all of interior Alaska.

Up into the least-known part of this mountain world we were flying in a Cessna 180, which we later learned to know as the “small but mighty” bird of the Arctic. Under the generous sponsorship of the New York Zoological Society and The Conservation Foundation, we were going to spend the summer as far north and as far into the mountains as we could get, in the valley of the Sheenjek River, to try to find what this Alaskan Arctic has to offer of wilderness peace and recreation and possibilities for scientific research.

On this half-overcast, mild first of June, Olaus and I and Dr. Brina Kessel, a young professor of zoology at the University of Alaska, had flown

by regular air service from Fairbanks to Fort Yukon, and there with no delay had been "inserted" with our baggage into the Cessna wheel plane.

The exploratory flights had been made the week before. Keith Harrington, bush pilot for Wien Alaska Airlines, stationed at Fort Yukon, had flown the two young men of the party, Bob Krear and George Schaller, up the Sheenjek the day before and landed them, with wheels, on the ice of a lake. So far as anyone seemed to know, this was the first such landing on ice in the Sheenjek valley. And Keith had made two more trips with all the supplies.

Now we were flying over the flat tundra north of Fort Yukon. The land gradually rose; we crossed a range of low hills, the Beaver Mountains. Then we saw our river, the Sheenjek, east of our course, winding its slow, looping way to join the broad Porcupine River.

The expedition camped in tents on the shores of Lobo Lake, deep in the valley of the Sheenjek River in the Brooks Range of Alaska. This is wilderness at its best, and still unspoiled.

Photograph by George Schaller

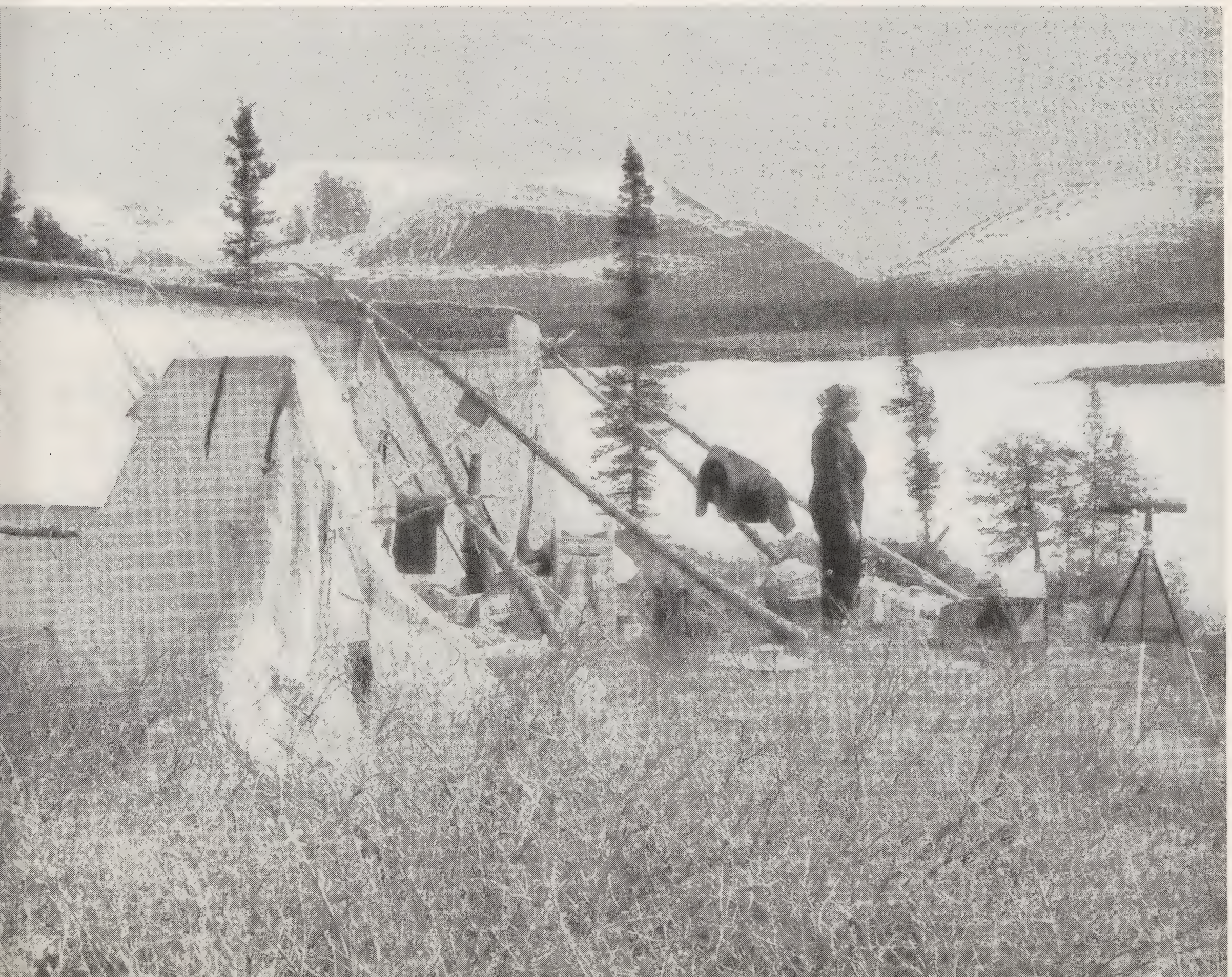
We flew for an hour and a half, and fingers of mountains were coming toward us. The white peaks far north in the pale blue sky began taking on outlines. Finally we were passing between shoulders of low mountains, the gateway, and the Sheenjek was below us again. All around, in the wide valley of its meanderings, were lakes, some reflecting the sky, some still solid white. Over the largest of the frozen ones our little plane banked, circled, and Keith shouted in my ear: "On the little bench above the lake—see the tents?"

Yes, and we saw the boys running, too, running out onto the ice as the plane touched down gently as a hawk and rolled crunchingly through slush ice to a stop.

George's first words were: "Brina! Two ptarmigan nests with seven eggs, already!"

And that exclamation set the tone of our first weeks at Lobo.

But mammals were not far behind birds in excitement. In the midst of the flurry of unpacking and trying to find food and prepare a meal, George was scanning the far shore for caribou. "Grizzlies!" he shouted, and he and Brina both



scrambled to find the telescope in the pile of equipment. Across the lake, across the river, up the far slope in a yellow grassy swale — there they played, two of them, chasing each other. When I took my turn at the telescope one of them was standing on its hind legs. They were very pale in color, paler than the dry winter grass they rolled and played on. Here was a first-night welcome, indeed!

In this age it is becoming a more and more rare experience to live in an environment wholly nature's own, where the only sounds are those of a natural world. Here at Lobo all sounds were charming, and I use the word in its original, strongest, sense — *charming*. Nearly always a little breeze was whispering through the small and scattered white spruce on the mossy hillside; there was the splash of a muskrat diving off the edge of the ice; ptarmigan crowing, clucking, talking and calling all around us; tree sparrows and white-crowned sparrows singing continually. Their voices became almost a background to all the other sounds. There was the scolding chatter of Brewer's blackbirds and what at first seemed very strange up there in the far north, our close friend of all the mild, domesticated places, the robin.

These were the voices of the hillside around the camp. Out on the lake, as the ice receded from the shores more each day (and the days were warm and never-darkening), we listened to other sounds, equally charming and exciting. Predominant in the lake chorus was the "Ah-hah-



wi, ah, hah-hah-wi" of the Old Squaw duck, and there was the churring sound of the white-winged scoters, the cheerful little three notes of

the baldpate and gulls making a fuss, too, at times. Lobo was about a mile long and half a mile wide, divided into two wings by a neck of tundra. Far across from us we sometimes heard the indescribably haunting call of Pacific loons, and then all the binoculars would be snatched up for a glimpse of these beautiful patricians of the north.

From my journal, June 3: "As I sit here on this soft mossy slope above camp writing, the writing has been very erratic because of those who live here. I have watched a band of fifty caribou



feeding back and forth on a flat a quarter of a mile away; ptarmigan soaring and cluck-clucking and giving their ratchety call, all about; tree sparrows so close and unafraid; cliff swallows hurrying by; Wilson snipe and yellow-legs calling; gray-cheeked thrushes calling. The three young scientists are beside themselves with all there is to see and do and record. Warm this morning — 78 in the sun."

To all the usual sounds were sometimes added new exciting ones. One night after we were all in our tents we heard, far over toward the river, a short, sharp cry. "A fox, I think," said Olaus, and then we heard Brina, out of her tent, with her glasses: "Oh, I see him; a cross fox, way beyond the lake, over toward the river, and there's an owl, diving at him — a short-eared owl I think!"

Little episodes like this made up our lives in Lobo, and we were all completely absorbed by them. The sights and sounds of our days and our daylight nights were not of our making or doing; we were simply the visiting observers of Spring in

the Arctic's natural world, trying to be as unobtrusive observers as possible.

Here it was easy to forget the man-world — to relax into this nature-world. It was a world that compelled our entire interest and concentration, all else forgotten. As we walked over the tundra our attention was completely held by the botanical achievement of that composition of moss, lichens, small plants and bright flowers, yet we were alerted to identify every bird, to note every evidence of bears — moss and roots dug up, tracks in the mud at the edge of pools. And since our way always led by either the river or some of the many lakes, we were identifying water birds, shorebirds, ducks, grebes. How could we be anything but absorbed?

We were a party of five. Each day after breakfast each one delved into the "snack box" and packed his own lunch — Jersey Cream biscuits, cheese, raisins, apricots, figs, chocolate — and with rucksack on back, camera and binoculars slung on, set off. Thus four or five different localities were explored on each trip. And the big news in our lives, related each evening as we returned to camp, went something like this:

"Three ptarmigan nests, one with seven eggs, two with six. Two tree sparrow nests. One yellow-legs nest. I saw three bands of caribou, and got close enough to photograph a cow and calf, and later, by that second little lake north of here, we stood behind a little spruce and a beautiful bull with a good set of antlers came right past us without knowing we were there and I got two pictures before he heard the camera."

Then I would break in.

"Olaus and I were eating lunch on the bank of the river and suddenly we saw a red-throated loon floating downstream. He went right past us, and the interesting thing was that as he swam along he constantly turned his head from one bank of the river to the other as though searching for something, and every few minutes gave that long lonesome one-toned cry."

Somebody else:

"I found a least sandpiper nest and the female stayed right around me, making little sounds, and getting back on the eggs right there within five feet of me, while I kept on taking pictures!"

Or someone would report:

"I got movies of a cross fox; maybe the same

one we heard the other night. He still had a beautiful brush, and he trotted and galloped clear across the flat by the river right in front of me. I don't think these animals up here know about man — they don't seem to have fear."

Lobo itself, we found, was the richest in all animal activity. On the days when we stayed in camp to write up journals, put up specimens or do camp chores, the animal world still claimed our attention. The girdle of water next to shore widened each day, but for ten days after we landed the ice was still a highway for animals. Bob sat just below camp one afternoon watching the performance of three muskrats. Suddenly they all dived. He glanced around. A fine big gray wolf stood above him on the slope. There is no way of knowing who was most surprised, but Lobo did not run. He merely turned and trotted back, and down to the ice, and we all watched him going away unhurriedly to the far shore. And that is how our lake was named Lobo.

A few mornings later, as we sat on the mossy slope at camp eating our stewed fruit, the first course of breakfast, a caribou appeared from behind a far point and moved onto the ice. Then came another and another, until there were about fifty, walking toward us. A sudden crawling of people to reach cameras and glasses, then motionless stillness. On they came, right across in front of us, silhouetted against the ice, heels clicking on it, blue sky and the low brown hills behind them. In the absolute stillness of that sunny morning the whispering sound of those many hoofs on the honeycombed ice was a sound like no other, and long to be remembered. Serenely they moved along, and stepped up onto the tundra at the far end of the lake. We all drew a deep breath. Brina said: "How many people in the world get to see anything like this? What a memory to have!"

These were the sounds and the sights of Lobo, but the land was no less exciting. When we landed on the ice of the lake on June 1, the snow was gone from the land and the prevailing color was brown; there was no green vegetation except for the little spruce trees. But there was one flower blooming flat on the ground, a deep red-purple-rayed single blossom, lone but definite announcement of winter's end — *Saxifraga oppositifolia*.



Multitudes of others were crowding it, and in only a week Lobo was a different place. The first week of June, in the Arctic, must be the most exciting one of the year. Dwarf birch, Labrador tea, heather, cranberry, all sorts of annuals and grasses and alpine blossoms came into bud, into leaf, into flower so fast we were bewildered. The botanists could hardly keep up with the show. On June 5 George made a trip to the north shoulder of Table Mountain, which we called "The Ridge." He came striding home across the ice just at six o'clock, three and a half hours from the top, after a long day and many miles of hiking and climbing with nothing to eat but a pocketful of raisins. "What a country! Those clear mountain streams, and those slopes, full of flowers, and such valleys! And from on top, the mountains just go like this, up and down, up and down — you just want to

Willow Ptarmigan were nesting in the tundra during the first week in June, when the expedition reached the Sheenjek country. This is a male. It was not frightened by the visitors.

Photograph by George Schaller

keep going, up one ridge and down another!" Then he proceeded to unload a gorgeous assortment of alpine flowers that had to be taken care of before dinner.

Two days later Olaus announced that he wanted to go "over to the mountain" to the foot of The Ridge. So I went with him "to" the mountain — and on to the top, of course. Even a bit further, over the top, "to see what's on the other side."

Our way led around the base of our camp ridge, which extended back from the camp and back from the lake, north along the river, then out

across a big belt of tundra pools and scattered spruce forest to a rather large lake half free of ice. On it were twenty white-winged scoters, several greater scaups and some pintails. Olaus sat down with the glasses. I said: "Come look here — there's something that looks like a grebe, and I don't know." The usual routine of his looking, saying nothing, handing me the glasses, and I, hesitating, "Well — horned grebe?"

"Yes, that's right. And I'm sure George and Brina haven't one listed yet."

So that was a highlight of that day, news to carry back to Brina.

We left camp at nine; at ten we were enjoying the lake and the ducks. At eleven we had sloshed and hopped and slogged across a great wet muskeg flat and were in the spruce again at the foot of The Ridge. At twelve we were half way up, still in spruce and some willow, but at the edge of the great slate slide that marks this side of the mountain. It was alpine-type mossy-covered rocks and mossy hammocks, with the roar of a stream in a draw nearby. We went over to it and sat on soft hummocks in a fairyland of moss plants, and ate our lunch, drinking ice-clear water from the stream.

We then began traversing, gaining altitude up over the treeless top third of the slope, among yellow, purple and pine alpine flowers, with pipits "pipit-ing" and once the sudden "snore" of the rock ptarmigan which flew off in front of us. This was Olaus's first climbing, but he didn't seem to get as winded as I did. I think we both noticed the helpful difference from our home altitude in the Tetons of Wyoming, for here our base was only 2,500 feet. We were only slightly out of breath — no heart pumping. The actual weariness of long-unused climbing muscles was the main reason for stopping. And it was this muscle-weariness that crept upon us toward the end of the long trek back at the end of the day. But the day was worth the price.

On top, across its carpet of mountain avens, heather, dwarf willow and dozens of other lovely small plants, a balmy breeze blew. The sun was high and blazing. I lay flat on the moss and heather, hat over face, and felt absolute content. This is not to be put into words. Here was I, privileged to lie on top of a mountain in the Arctic — an observer of the richness of this short

summer pageant. Through half-closed eyes I looked across the valley to west and north. The mountains made an unearthly beautiful frieze against the blue — numberless, snowy, streaked with dark, various in shape, shoulders, domes and spires and castles, and cliffs and screes on their slopes reaching to the darkness of the forest belt. And then the broad valley, the winding Sheenjek, the countless lakes. I know nothing of painting, but I felt for a moment the urge a landscape painter must experience — the feel of brushing great strokes of brown, and fawn, and purple-gray and silver upon canvas. Gaze at such a scene, through half-closed eyes, from a mountain top; it strikes through to your inmost heart. Here is experience well rounded to a perfection. The place, the scene, the breeze, the bird song, the fragrance of myriad brave burgeoning mosses and flowers, all blend into one clear entity, one jewel. But how to describe this entity? It is the Arctic in its unbelievably accelerated summer life. It is also the personal well-being purchased by striving — by lifting and setting down your legs, over and over, through the muskeg, up the slopes, gaining the summit — man using himself. This wondrous mingling of weariness and triumph and sudden harmony with the exquisite airs, the burgeoning life of the bird and plant world of the tops, is part of the "glad tidings," surely, which John Muir meant.

This was June 7, end of our first week at Lobo. From the river, from the lakes, from the valley floor, to the top of a mountain, we had observed the richness of life in myriad forms, and yet we knew it was only the beginning. We hear always of the great abundance of life in the tropical regions, and it is true. And yet, here in the Arctic, our overpowering impression from this first week in the Sheenjek country was of abundance of Life.

Lying in the little tent that night, bandana tied over my eyes to keep out the light, I listened to the sounds of Lobo. The ptarmigan, robust and comical, "Come here, come here, come here," — "Go back, go back, go back;" the tree sparrow, cascade of sweet notes; the white-crown, plaintive, questioning, but strong. Always these three voices, and always from the lake the ducks, the loons, the gulls. This was their world. We, the fortunate visitors.

The Aquarium's First Collecting Trip

By THEODORE KAZIMIROFF

Fellow of the New York Zoological Society

LONG BEFORE Stage One of the new Aquarium is officially opened at Coney Island this spring, "first time" occasions will have lost their novelty. There will be the very first time the giant pumps start throbbing and pure sea water flows through all the hardrubber veins and arteries, the first time the entire filtering system is put into operation, no doubt the first little emergency when some new tankman forgets to turn a valve and a reservoir overflows . . .

But now the sense of novelty is still strong and I am glad I shared in one of the really historic occasions: the making of the first fish collection down among the Florida coral reefs.

It was, in fact, a historic occasion in more than one way. The first collection of living fishes for the new institution, certainly, but more importantly it established a fact. It proved by the severest test possible that the Aquarium is not season-bound and weather-restricted. For consider what happened:

Between December 30 and January 9, a hastily assembled crew of three men (only one of whom was experienced in collecting) drove a truck to



Key West, made a brilliant collection in those all-but-tropic warm waters, and delivered the collection at the doors of the Aquarium with the loss of but four fish out of hundreds of specimens. And New York in early January was *not* enjoying tropical or even sub-tropical weather. On the contrary.

The entire trip covered some 3,400 miles, about half of it in the cold, snowy, icy latitudes. It proved conclusively, as far as Director Coates is concerned, that the Aquarium can now collect fish at any time of the year, anywhere that the truck can operate.

Before the old Aquarium closed at the Battery some sixteen years ago, its battered but seaworthy well-boat, the *Seahorse*, used to ply local waters in spring, summer and early fall. Florida shipments were a summer proposition, for winter collecting and shipment by freighter was considered risky and never practiced. But a good many months ago Mr. Coates began thinking about new ways to do old things. America moves almost anything by truck nowadays; why not fish?

He ordered a specially designed fourteen-ton



truck and fitted it with two 350-gallon tanks, a 200-gallon overflow tank, circulators, heaters, aerators, 110-volt generators, cab-to-truck inter-communication system, racks for nets, traps, boots, fishing gear — everything that a piscine Pullman could possibly need to travel anywhere anytime in complete independence of fixed installations. Nobody quite had the courage to refer to it as Coates's Folly, but comments *were* made that if the Director ordered anything more installed, it would have to be greased before it would slip into place.

The collecting crew told me Mr. Coates stood in the Aquarium's front door on December 30, waved cheerily as the collecting truck rolled away, and shouted: "You won't have any trouble."

They didn't. It worked.

* * *

I GOT TO TAKE PART in this gratifyingly successful undertaking because I know Key West so well from having spent many winter vacations down there at the southernmost tip of the continental United States. I had arranged to be in Key West two weeks before the truck arrived,

and Mr. Coates suggested I might like to establish a few contacts among the fishing people, line up a well-boat and generally make myself useful as an advance man.

Years ago there were plenty of well-boats in Key West, but not any more. Victor Lang, director of the Key West Aquarium, helped me comb the wharves and coves for well-boats and the combing turned up just exactly one suitable craft. However, we couldn't have used more than one, even if there had been a dozen, so that was all right. Its owner volunteered to dry-dock it immediately, scrape the bottom, overhaul the engine and assign an experienced sponge-fisherman as her skipper. What more could anybody want?

Maybe it was my native New Yorker skepticism, maybe long experience with Key Westers. I shook hands with the well-boat owner to seal the agreement — but just the same, privately and without making any particular point of it, I

Brilliant Key West fishes such as these were captured during the Aquarium's first collecting trip. The collectors brought back grunts, snappers, groupers, angel fishes and others.

hunted up an old friend, Capt. Tommy (Blackbeard) Lones and suggested that maybe the Aquarium crew would like to go out on his fine big charter fishing boat and pick up what they could. That was fine with Blackbeard. Any time — they'd be welcome.

The Aquarium crew rolled into Key West on New Year's Eve. New Year's Day I re-confirmed everything with the owner of the well-boat and went away feeling ashamed of myself for my double-dealing approach to Blackbeard Lones.

"Sure 'nough, everything's all set. Skip'll have her at the Municipal Pier at 10 o'clock tomorrow mornin'. You fellows be ready, now — don't you keep him waitin'."

Who keep who waiting? Around noon the next day I finally caught up with the skipper of our promised well-boat. He had been celebrating the New Year for 36 hours already, and the end was nowhere near in sight.

* * *

AGE OLSEN, Joe Armstrong and George Fay, the Aquarium crew, had plenty of small chores to do while I tracked the beer-can spoor

of the well-boat's skipper, but it is hard for the younger generation to be patient. My son Ted had to do *something* while he was waiting for the well-boat or its substitute to show up, so he pulled a face mask over his sunburned forehead and slipped over the side of the Municipal Pier for a few minutes' skin-diving. And thereby he discovered that we were sitting on top of the most wonderful and beautiful school of angel fish in Key West — all within a hundred feet of the Key West Aquarium, right under the pier. Not only angel fish, but grunts, jacks, barracuda, boxfish, squid, morays, spiny lobsters, spider crabs, hermit crabs, brittle stars, giant anemones and — well, just about everything Key West waters contain.

That was too good an opportunity to miss, so part of the crew assembled a keep-alive box that had been built in New York, and lowered it into the water under the pier, hoping to catch something overnight — if Ted would come up and let the fish settle. He finally did come popping to the surface with a shout that brought tourists flocking to the pier's edge. It seemed to be "Mshlursoray oorsl!" and after he took the breathing tube out of his mouth it became more intelligible as "Moray Eel!" He had brought up the first specimen, a Spiny Boxfish scooped up in a hand net, and with a little encouragement and more warnings to be careful he went down again and picked the moray out of a chunk of coral. Beau Gregories, spiny lobsters, spider crabs, starfish and an enormous hermit crab complete with its Triton conchshell home came up soon afterward.

When that sport began to pall, the crew borrowed the Key West Aquarium's 14-foot skiff and putt-putted off to a nearby key to look for Nurse Sharks. I returned from my skipper-quest just in time to see the skiff return, half awash with its overload of passengers and four 4-foot, harmless but pretty sharks.

The bulk of the Aquarium's first collection was formed in the next two days. Overnight the keep-alive box under the pier trapped a handsome array of Blue Angels, Black Angels, French Angels, grunts and parrot fishes. And ever-reliable Blackbeard Lones extended the welcome he had promised aboard his charter boat. With the overflow tank from the Aquarium collecting truck as a makeshift fish-well, the Aquarium crew

sailed out with Capt. Lones and came back with all the Hog Snappers, Silver Snappers, grunts, morays, Margates, Mutton Fish, Yellowtails, Blue Runners, Red Groupers, Rock Hinds and Nassau Groupers we could possibly want. Even a rather rare little Ribbon Fish.

It was absurdly easy. The charter boat, the *Gulfstream*, was crowded with tourist fishermen who were only too glad to toss into the well anything rare or unusual or especially pretty that came up on their lines. The only trouble was that many of the fish were hauled up from considerable depths — 75 feet or more — and most of them were afflicted with a form of the "bends." That is, when put into the well at the low surface pressure, they promptly turned upside-down with distended bellies glistening in the sunshine. The old Key West trick for curing that trouble is "air bleeding" and the usual Key West instrument is the sharpened rib of an umbrella, for its triangular shape leaves a tiny flap of skin that acts as an air valve. Having no sharpened umbrella rib, I used the ship's icepick, gently inserting it just behind the pectoral fin and puncturing the air bladder to relieve the pressure. It worked perfectly and every single fish survived not only the sea part of the trip, but the long journey back to New York.

On the next and last day of fishing we chartered our own boat so as to work the reefs where the smaller fish lurked. In twenty feet of water so clear it seemed to be only a foot or so deep we anchored and Ted and I slipped over the side into an aquatic paradise. I have spent many hundreds of hours exploring underwater but not many of them in such an exquisite garden. From the surface the crew fished; I stayed below and soaked myself in color and form and movement and tried to capture some of it with an underwater motion picture camera.

Knowing better, knowing that there was no danger . . . nevertheless I summoned Ted and we came up and climbed into the boat when a dozen barracuda began circling, circling, circling . . .

But the spot to which I *must* return, and to which I hope the Aquarium will send a collecting party before the actual opening of the Stage One building in the spring, is a submarine gorge in the coral a few hundred yards from the place where we first went down to the reef. Fish come

and go, I know, but I think there will always be something we want there, and revisiting that brilliant, ever-moving, living chasm beneath the sea is an experience I would like to have again and again.

I would have explored it more closely this time but for one thing; it was already fully occupied.

From every crevice in the coral jutted the head and the gently opening and closing mouth of a Giant Grouper. And at a little distance, swimming lazily and watchfully around and around, there was a school of sharks. Just waiting to see who would make the first move.

I did.

News from the Conservation Foundation

Cooperation with Herald Tribune Fresh Air Camps

Arrangements are now being worked out for joint participation with the Herald Tribune Fresh Air Fund in a three-year project to improve techniques in conservation education in summer camping. We should have more details regarding this program in the next issue of "Animal Kingdom."

Latin-American Interest

Spanish and Portuguese versions of our educational films are receiving ever-widening circulation below the border. And now a Spanish translation of our "Soil Erosion Survey of Latin America" has been published and distributed to government officials concerned with conservation policies and practice.

Natural and Social Sciences

Arrangements have been concluded between the Conservation Foundation and The Joint Council on Economic Education for sponsorship of companion volumes: "Teaching Science Through Conservation" and "Teaching Social Studies Through Conservation." The former, by Martha Munzer and Paul Brandwein, for which the Conservation Foundation is primarily responsible, has been completed in rough draft and should be ready for press by June 1957. The latter, for which The Joint Council is primarily responsible, should be ready for press about one year later.

College Teaching

"Conservation Education in the Colleges and Universities of the United States," by Charles E.

Lively and Jack J. Preiss is now in the process of being printed by Ronald Press, and should appear in late Spring or early Summer.

School Teaching

The collection and analysis of curriculums as they relate to conservation from Kindergarten through Grade 12 in the public schools of the United States is being carried out by Elizabeth Hone. Work on this project is progressing rapidly. When completed — we hope by August 1 — we should know far more accurately than is now known what is being *attempted* nationwide in conservation education and resource-use teaching.

The second phase of this project, namely to discover *what is actually taking place in the classrooms*, will be initiated shortly after the preliminary phase has been completed.

Educational Television

Mr. John C. Gibbs, Chief of the Audio-Visual Department, has been appointed to the programming committee of the Metropolitan Educational Television Association.

Graduate Study and Placement

Roger Hale is actively engaged with representatives of industry and government in developing a program, stemming from the Ann Arbor Conference of last Spring, on graduate training in conservation. This program aims at bringing about a sharper realization of industry's need for personnel (working in area development, planning, watershed management, banking, etc.) who have had graduate training in conservation. The program also aims at encouraging universities

now offering graduate training in conservation to provide special courses for meeting the requirements of industry.

A permanent committee, presently consisting of the former chairmen of the sub-committees of the Ann Arbor Conference, has been established and is functioning toward these ends.

Discussion Guide

More than 3,000 copies of "Concepts of Con-

servation" have been distributed since its publication last summer.

Radio Program

The 13-week radio program which was broadcast over the NBC national network last spring and summer, being carried in whole or in part by 36 stations, is still active. Nine independent stations in cities not involved in the original broadcast, have carried or are now carrying some of these programs.

BEHIND THE SCENES

**NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH**

Osborn and Nigrelli Participate in AAAS Meeting in New York

President Osborn was one of the key speakers in a symposium on "Resource Development and Population Growth" organized at the meeting of the American Association for the Advancement of Science in New York during the last week in December. He spoke on "Our Reproductive Potential" at a meeting organized by the sections on "Industrial Science" and "Social and Economic Sciences." His talk, received with great interest at the meeting, was widely quoted in the press, and will be published in *Science*.

Dr. Nigrelli was organizing chairman of a symposium on "New Ideas on Spontaneous Generation" at the AAAS meetings.

"Old Bum," the Bowery Alligator, No Longer with Us

Some eight years ago a small Alligator was brought to the Reptile House by a most unlikely pet-owner — an elderly derelict of the type usually called a "Bowery bum." He explained that some months before he had rescued the reptile from a gang of boys who were stoning it in a Bowery street. Where it came from, he did not know; presumably it had been liberated by someone who had brought it back as a souvenir of a Florida trip, since that is the origin of most of the baby Alligators that are presented to the Zoo.

The derelict cherished the battered little Alligator, took it to his room, fed it on hamburger, and kept it warm during the winter by letting it sleep with him.

He explained that it was necessary for him to have an operation, and since he had no one to take care of his pet he was turning it over to the Zoo.

Some weeks later, obviously just out of hospital, he came back to the Zoo to see his pet. The operation had been a partial success but he would have to have another one shortly, he explained. Before returning to the hospital, he wanted to see his little Alligator. He promised to return again after the second operation, but he never did, although it is certain that he would have done so had he survived.

In the years since then, "Old Bum," as the Alligator was affectionately named, has become one of the favorites of the Reptile House. Unlike most Alligators, it was and remained quite tame and readily allowed itself to be picked up and handled. Under conditions of warmth and plenty of food, it grew rapidly and recently was measured at 7½ feet — too long to be readily picked up by its keepers, although it made no objection when they attempted to do so.

Now "Old Bum" has died, from gastro-enteritis. It is doubtful that we will ever again have such a docile Alligator. Certainly not one with such an unusual history.



Mechanization may be faster for big jobs of snow removal, but during a heavy snowfall in January the Zoo's motor plow was busy elsewhere and Jenny, the Donkey, went to work.

Dr. Beebe Reports on a Quest for Butterfly Eggs

Following his custom when the Department of Tropical Research is on one of its expeditions, Dr. William Beebe has sent a report of the activities of the Department from December 12 when Dr. Beebe, Miss Jocelyn Crane and Miss Barbara Young, the latter a new addition to the staff, sailed from New York on the Alcoa Line *Partner* for Trinidad, to early January.

Stops en route are usually devoted to collecting or observing whatever the Department is working on. When the *Partner* steamed up the Surinam, Commewijne and Cottica Rivers in Dutch Guiana, Dr. Beebe wrote:

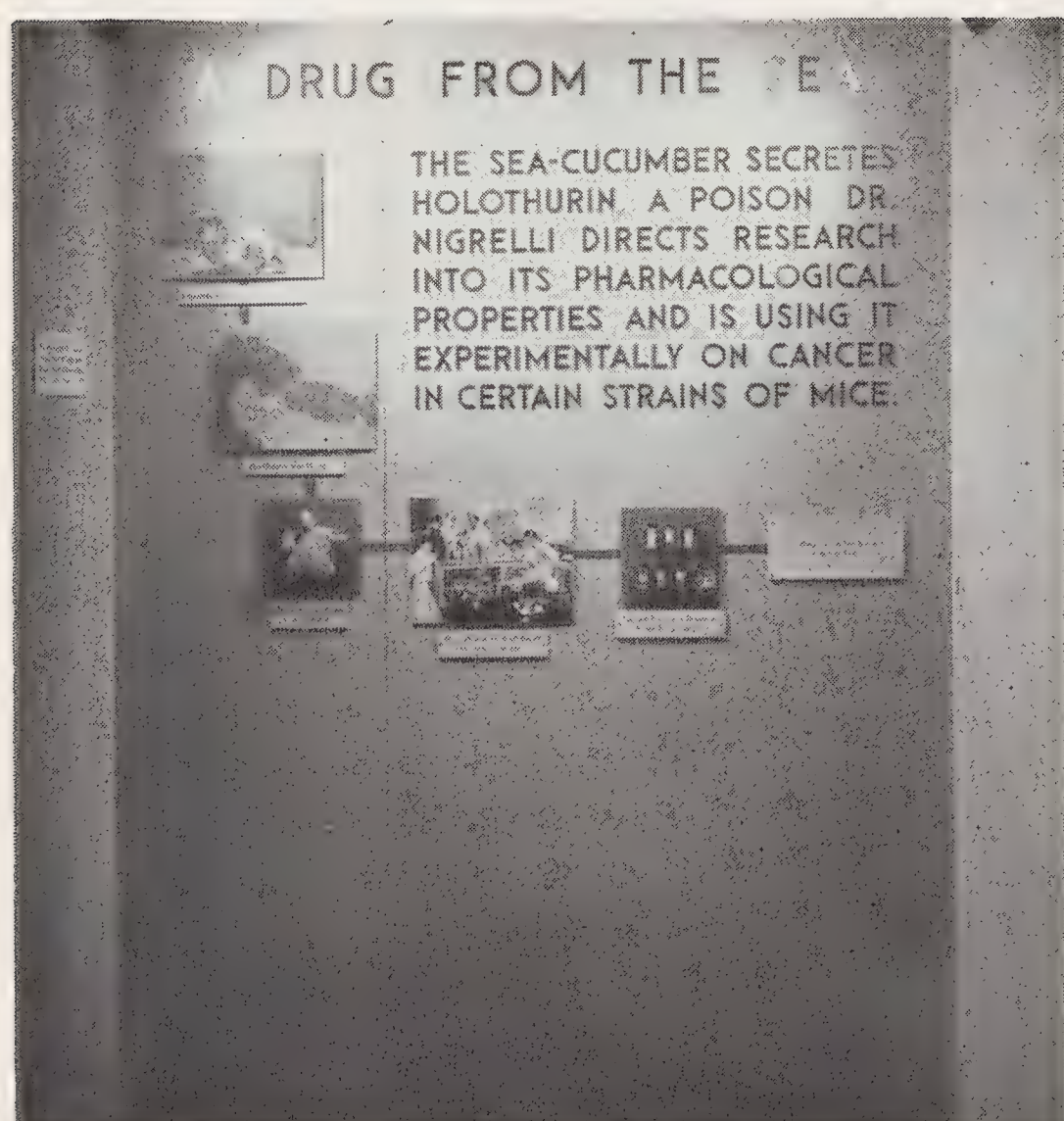
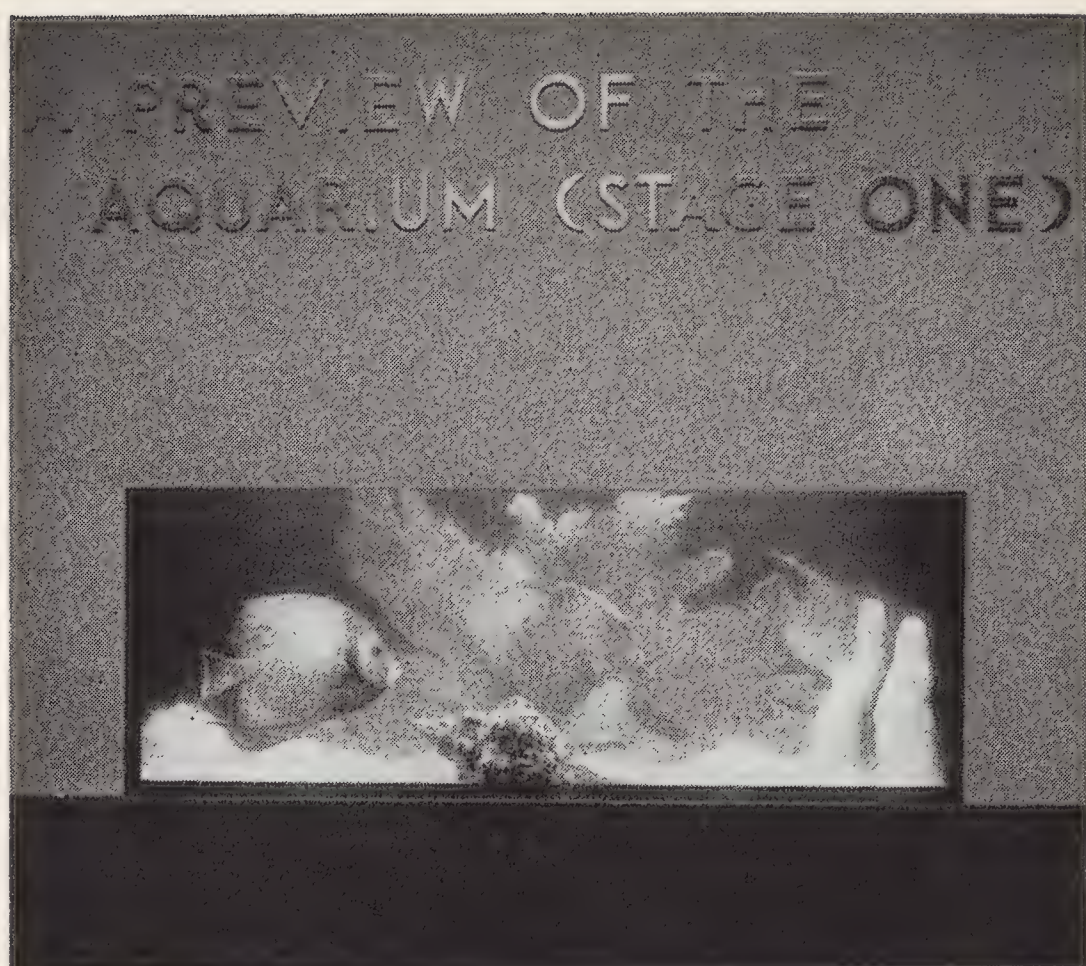
"At Moengo, we had four hours of remaining daylight. The manager of the bauxite mines met us and drove us furiously through rain, mud and sand to Casa Blanca. This was where we spent a month, three years ago, as guests of Director and Mrs. Meijer. In the garden we found a large trellis of passion vines, planted, as promised, by our kind and thoughtful hostess, but examina-

tion of these and those climbing over our insectary revealed not a single egg.

"From here on, we had remaining two hundred and forty minutes of daylight to find and collect eggs of the heliconid butterflies we were studying, eggs which were one-seventeenth of an inch in height and laid only on the dark-green leaves of a particular species of passion vine. We covered twenty-five miles of road, leaping out of the car at any sight of a favorable place. We failed!

"Muddy, wet and discouraged, we returned to the *Partner* to find thousands of Gray-breasted Martins swinging about in dense flocks and alighting on the guy wires of the bauxite factory.

"On board, just before dinner, Jocelyn disappeared and was later located by loud, incoherent screams, whether of pain or joy we could not tell. Finally, she was located in the heart of a brushy tangle growing out of muddy bauxite. The outcry proved to be of joy, for she had found three eggs and five just-hatched caterpillars before the last night of 1956, New Year's Eve, closed down. The god of happy scientists was with us and all eight caterpillars were thriving and eating heartily when we arrived at Simla three days later."



ANNUAL MEETING SCENES

The Zoological Society's annual Members' Meeting returned to the Waldorf-Astoria on January 18 and thus again had an opportunity to show, in panels and other types of exhibits, some of the things we have been doing the past year and some of the newer and most attractive animals. The Ballroom was filled to overflowing for the program of motion pictures and addresses by President Osborn and Park Commissioner Robert Moses.

Long-wattled Umbrella Bird Is on Display Again

When Charles and Emy Cordier, at that time the official animal collectors for the New York Zoological Society, returned from Ecuador in 1950 one of their treasures was the Long-wattled Umbrella Bird that had never before been exhibited. We promptly placed the bird on exhibition, and almost as promptly it demonstrated that it did not like the proximity of other birds and people — so much so that after a few weeks it had to be retired to the so-called Quarantine Room in the Bird House where it could have almost complete seclusion.



Long-wattled Umbrella Bird

In an attempt to satisfy the requirements of both bird and visitors, Mr. Conway has installed heavy, broad-leaved planting in one of the compartments in the main hall of the Bird House, and the Long-wattled Umbrella Bird is again on

display. After a week in public view it seems to have accepted this invasion of its privacy with good grace and we are hoping that the thick planting will enable it to be kept on exhibition.

Aquarium Staff Moving to Coney Island

After being "guests" of the Zoological Park since the fall of 1941 when the old Aquarium at the Battery was dismantled, the staff of the New York Aquarium started moving to the new Stage One Aquarium building overlooking the sea at Coney Island during the last week in January. The operation of moving offices, laboratory equipment and many of the fishes to the new home will be completed during February.

IN BRIEF

More Fish from Mexico. The arrival by air of seven boxes of live fish (in plastic bags partly filled with water) was the first indication at the end of the January of the success of Dr. Myron Gordon's recent collecting trip in the state of San Luis Potosi in Mexico. Subsequently, letters reported that Dr. Gordon and his associates, Donn Rosen and Malcolm Gordon, had collected five species or subspecies of swordtails and one platyfish, and were hoping for success in their efforts to collect another subspecies of platyfish. The fish will be used in studies in the Aquarium's Genetics Laboratory.

President. Dr. Ross F. Nigrelli, the Aquarium's Pathologist, assumed office as President of the New York Academy of Sciences on January 1, to serve through 1957.

Muyoni Is Improving. Muyoni, our new female Okapi, was heavily infested with parasites and was in poor general condition when she arrived at the Zoological Park on November 1, 1956. Under treatment constantly since that time, she is now showing definite improvement and it is likely that she can be quartered with Bilota, the male, this coming spring.

Mid-winter Babies. Five Dingo pups were born on December 23 and are now beginning to venture forth from their shelter outside the Kangaroo House. Since November 23 we have had occa-

sional glimpses of a young Agile Wallaby in its mother's pouch in the same building. And at the African Plains winter shelter, the keepers are watching with pride and satisfaction the well-being of four Nyalas born between January 4 and 10. In the last few years there has been a fairly high mortality among newborn Nyalas, but the present crop seems strong and healthy.

Longevity Record. A longevity record for the species apparently was established by an Anoa, or Pigmy Buffalo, which was born in the Zoo on July 16, 1928, and died on January 10, 1957. This was a period of 28 years, 5 months and 25 days. The best other record known to us is of an Anoa in the St. Louis Zoo which lived just under 24 years.

PUBLICATIONS OF INTEREST

FAUNE ET CHASSE EN AFRIQUE OCCIDENTALE FRANÇAISE. By Georges Roure. Many photographs, maps, and black-and-white illustrations by Lucien Blancou. 412 pp. Editions G.I.A., Dakar; Distribution: Librairie René Thomas, 36, Rue Geoffroy-Saint-Hilaire, Paris (Ve), France. 1956. [No price stated].

This is a rather specialized publication, noted here because it deals thoroughly and competently with a part of the world about which there is nothing comparable in print, except a 1952 edition of the same work. The subtitle is "Guide du Tourisme de la Nature Vivante," and it is exactly that — a guide to the wild animals of French West Africa, with lists of mammals and birds, scientific and popular names, copious illustrations, ecological discussions, suggestions for photographing and hunting, itineraries by which animals can be visited, abstracts of conservation laws and a bibliography. The text is, of course, in French. It is not a scientific reference work, but as a popular guide to the fauna of the country it is excellent. — W. BR.

New Members of the New York Zoological Society

(Between November 1 and December 31, 1956)

Patron

Miss F. E. Quinlan

Life

Mrs. Marshall Field

Contributing

Cass Canfield
Miss Linda Darnell
Harry Eldridge
Mrs. John Elliott, Jr.
Miss Frances Ferguson
Fred J. Freese
Mrs. David Grace
Dr. Samuel F. Groopman
Melville B. Grosvenor
Mrs. Roger D. Hale
Daniel Kingsford
Charles Kiuttu
Paul W. Knaplund
Myron Mayer
Allan J. McIntosh
Roy R. Neuberger
Dr. William J. O'Connell
Ben Park
Mrs. Charles R. Peck
Henry L. Pierson
Orville Prescott
H. W. Schimmelpfeng
Robert C. Stover
Mrs. M. Brown Trimble
Hunt T. Wagstaff
Mrs. Thomas J. Watson
Norman Weiden

Annual

Mrs. Beverly W. Abrams

Siegmund Adler
Dr. Evelyn Apogi
Robert O. Babcock
Mrs. Dana C. Backus
Lt. Joseph P. Belmont
Paul Blum
Dr. Thomas Lee Bucky
Mrs. Fulton Cahners
Mrs. S. Park Cleveland
Miss Barbara Colbron
Miss Florence Davey
Miss Diana M. Dennison
Mrs. Herbert Dimondstein
Dr. A. Philip Dinin
John G. Edwards
Dr. Nathan Eisen
Dr. William J. Eisenmenger
Dr. Max Ellenberg
Martin Forscher
Mrs. Jo Ann Forster
Mrs. Helmut N. Friedlaender
Dr. Alexander J. Friedman
Dr. Norman Goldfarb
Richard E. Green
Miss Lois M. Grier
Paul Grillo
Louis Joel Halpryn
Miss Marie L. G. Halsted
Dr. Emeline Place Hayward
Mrs. John H. Healy
Mrs. Sidney Hechinger
Carl Holmes
Thomas Howley
Robert Hurwitt
Mrs. E. Powis Jones
Dr. Theodore Kamholtz
Miss Helen Ann Leavenworth

Dr. Arthur Lind
Mrs. Ronald Macdonald, Jr.
Master Jeffy Magnes
George A. Mallett
Dr. James A. L. Mathers
Dr. Valentino D. B. Mazzia
Harry A. Moody, Jr.
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Dr. R. S. Mumford
Dr. C. Paul O'Connell
Mrs. William A. Paddock
Dr. Frank H. Peters
Mrs. V. Petrucelly
Vito A. Poveromo
Dr. Alex Rabinowitz
Dr. Vincent E. Ragaini
Dr. Robert M. Robbins
Master Don Hall Rosebury
Dr. Philip Rosenblatt
John David Russell
Dr. Julius Schneiderman
Jules Segal
Dr. Henry Siegel
Benjamin Silver
Nate Sock
Thorwald Ternstrom
Dr. John J. Vasile
Dr. Louis J. Vorhaus, 2nd
Robert Vranek
Dr. John L. Walker
Miss Annie R. de Wasserman
Dr. Robert J. Weisenseel
John Barry Zischang

It won't always be winter

UNLIKE Woodchucks, Pipistrelles, Western Ground Squirrels and Jumping Mice, the Zoo doesn't hibernate all winter. Awake and above ground, its temperature is normal—far above the winter torpor temperature of the Little Brown Bat, for example.

Of course, we don't see too many visitors these chilly days *—and that's one of the reasons we were glad to see some 2,000 members and friends at the Waldorf for our annual meeting January 18. The enthusiasm that evening foretells (we hope) many visits to the Zoo this coming year by members, and their friends who (we hope) may soon become members. (And they will, if you ask them or send us their names and addresses so we can send information about Society membership.)

Plan one or two Zoo visits for the months ahead. Membership privileges are designed to make your visits more enjoyable, so we urge you to use them. And don't forget to tell your friends about them.

MEMBERSHIP COMMITTEE
The Zoological Park
New York 60, N. Y.

* Even on the coldest, most miserable day, some visitors always come to the Zoo. As far as anyone on the Staff can remember, the record low for visitors was 7, years ago. And what a terrible day that must have been!



ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

PRESIDENT Fairfield Osborn	VICE-PRESIDENTS Alfred Ely Laurance S. Rockefeller	SECRETARY Harold J. O'Connell	TREASURER David H. McAlpin
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Commissioner of Parks, Hon. Robert Moses

STAFF: Zoological Park and Aquarium

John Tee-Van *General Director*

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LX	APRIL
1957	No. 2

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Public and Private Partnership

THERE EXISTS IN NEW YORK CITY a partnership which, as far as I am aware, is not paralleled elsewhere. This is the working alliance between the City government and the so-called quasi-public institutions — the museums, the botanical gardens and our own institution. This alliance was first formulated some eighty or more years ago by City officials and groups of private citizens and subsequently formally established through legislation by the State of New York. In essence, this legislation provided that the management of these institutions should be the responsibility of private citizens under the surveillance of City officials, basic costs of operations to be supported by public funds.

The originators of this plan could barely have dared to hope for the excellent way in which this arrangement has worked out in practice. All of the institutions have been able to grow and develop free of undesirable political pressures. This in itself is a remarkable fact. Further, these privately run institutions have come to represent a highly important element in the life of this great City, attracting to themselves an aggregate attendance that averages more than twelve millions each year.

Public funds, together with large amounts of money contributed from private sources have resulted in the creation of centers of the arts, of the sciences, and of public recreation that are second to none in any great city in the world. New York can justifiably claim an example of public and private partnership at its best.

Fairfield Osborn

ADELIE PENGUIN



F THE ANTARCTIC

By WILLIAM J. L. SLADEN

Medical Officer, Falkland Islands Dependencies Survey

Members of the Zoological Society who attended the Members' Meeting in January will remember the fascinating film, "Adelie Penguins of the Antarctic," which had its preview that night. Dr. William J. L. Sladen, the British medical officer who made the picture, is now in the United States in connection with certain research problems, and we asked him to tell something about the life of the Adelie Penguins and how he made the film. His account follows. —

EDITOR

THE "CLOWNS OF THE ANTARCTIC" are inquisitive and fearless black-and-white flightless birds, the Adelie Penguins. Explorers are charmed and amused by their waddling gait, and their habit of flopping onto their bellies to toboggan along at high speed over the ice and down snowy slopes. They stare solemnly at their first meeting with a man, they steal stones from their neighbors, and they display and fight. All who have seen them on the shores of the Antarctic white wildernesses are sure to keep an affectionate feeling for them as little comic human mimics.

Not all penguins live in the Antarctic, but none of the seventeen species lives in the northern

hemisphere, except in zoological gardens. Eight species breed on the Antarctic continent or the surrounding islands. The others are found in Australia, New Zealand, South Africa, Chile and Peru, and even as far north as the Galapagos Islands on the equator in the Pacific Ocean. However, the Antarctic is the place for seeing penguins in really vast breeding colonies.

I first went down to the Antarctic, nearly ten years ago, as doctor and biologist to the British Expedition, the Falkland Islands Dependencies Survey. As biologist my chief objective was to make an intensive study of the Adelie Penguin (*Pygoscelis adeliae*), which is the commonest species, and there was wonderful opportunity to do this, and to actually live among them. My first year, 1948-49, was spent in a mountain-encircled bay (Hope Bay, in Graham Land, or Palmer Peninsula) where in the spring and summer about a hundred thousand penguins covered rocky promontories with their nests and filled the air with their raucous calls. Here it became obvious how close Adelies live to the edge of success in their battle with bad weather. Winds howled down between the mountains, at times reaching more than a hundred miles an hour. Frequent blizzards at a crucial time that year

Bits of ice and frozen snow cling to the bodies of these young Adelie Penguins after a blizzard, one of the hard conditions they face in Antarctica. They are about ready to go to sea.

All photographs by the author.

upset the breeding routine of most of the pairs. Deep snow hid incubating birds from their mates, and this eventually brought about widespread desertion by the starving, unrelieved birds on the nests. Eighty to ninety per cent of the eggs were lost and Adelies do not lay again in the same season. This was a most interesting year for my investigations, if not for the penguins!

We had our own misfortunes at the expedition base that year, for at the beginning of November the base hut was completely destroyed by fire during a blizzard, and for the following three months we lived in tents until the expedition ship was able to reach us. From the point of view of studying the penguins, this could not have been better. My tent was placed within a few yards of a colony of Adelies. But the motion picture camera and all the film were lost. Perhaps this, too, was a blessing, for I was able to concentrate on understanding the birds thoroughly the first year, and thereby to know what I wanted to film to illustrate their life history during the second year.

The second year, 1950-51, was spent at Signy Island in the South Orkneys, where our base was two and a half miles from a mixed breeding rookery of Adelie and Chinstrap (*Pygoscelis antarctica*) Penguins of about half the size of the Hope Bay Adelie rookery.

This time there was no big penguin catastrophe, so I had a good set of observations and experiments for contrasting with the others, and returned with enough material to make a color film of the Adelies' fascinating life history.

Marking, photography and dissection were for me the most important aids in such an investigation. About 1,300 birds were individually identified by temporary paintmarks, 338 by numbered aluminum flipper bands that last several years, and others by temporary colored celluloid bands. Whenever other food for our dogs was in such short supply that they had to be fed on penguins, I saw to it that the victims were birds that would give me maximum data. There was no danger to the penguin populations of over 100,000 strong, providing the collection was done scientifically. Dissection was particularly necessary to prove the veracity of the signs previous workers and I thought might tell us which were males and which females of all these identical-looking

creatures. Many mistakes had been made before because the simple fact of which is male and which is female is very hard to establish. However, I do not want to write about these aspects, but rather to recount the story that the film illustrates.

When the days started to get longer, the time of the Adelies' return to the breeding haunts drew nearer and the small party of scientists that had wintered at our British expedition base grew more and more excited at the prospects of seeing the penguins again. Admittedly, some of this excitement centered round the pleasant anticipation of fresh fried penguin eggs on toast, but this was by no means all; for the return of the Adelies marked for us the end of winter, and the promise of the return of our expedition ship. For the biologist there was the added eagerness of looking for old friends again, especially for the penguins that had been marked with aluminum bands in previous breeding seasons. The winter home of the Adelies is the fringe of pack-ice which separates the solid ice (which spreads from land across the sea in winter) from the open water of the southern oceans. At this time of the year the sea ice may stretch from 20 to 60 miles from land, varying from year to year and from place to place. At the best it is a long and foodless trek to their nesting colonies on land for these little flightless birds no more than 18 inches high. The surface is very rough. Winter snow has collected on the sea ice which has been pressed into grotesque shapes and ridges. How do they find their way? This is still an unanswered question.

The usual walking speed of the Adelies is about three miles an hour. They can run at twice this rate, but when they really want to hurry they can toboggan on their bellies with flippers and feet working rapidly against the snow surface and can outdistance a sprinting man.

The Adelies have no chance to feed when they have left the sea behind them, so they have to start on a long fast. Now the penguin rookeries become the noisiest places anywhere in the Antarctic. Every sort of penguin social activity is going on. Our banding recaptures have shown that birds that have bred before come back to the same nest sites and on the whole are very faithful to their former mates. They start build-



These two Adelies on their nest of stones, before the eggs were laid, have been marked by numbers and aluminum bands.

Heads tucked under the parent's body for warmth, two chicks are snug and safe. They are covered by thick down at this early age.

ing nests of stones and keep other birds off their territory. Those breeding for the first time may cause a lot of commotion trying to establish their own territory and to attract a mate. The male slowly stretches his bill to the sky while beating his flippers back and forth, and eventually at the limit of his stretch emits a long, strange call like a husky hen over her freshly laid egg. Earlier biologists called this the *ecstatic display*, though it does not really seem to express any sort of well-being. It does, however, attract females, and repels other males also. I remember the fickle behavior of one female Adelie in response to ecstatic displays. A well nourished male, just back from the sea, was bending over his nest and the female



was by his side when I first saw them. Then a single male at a nearby nest slowly elongated himself into the ecstatic display with its prolonged sound of "kug-gu-gu-gu-gu-ga-aaaa." The female ran to his side, but returned to her first place when the first male went into the display too. Five times she ran from one to the other as they alternated in their ecstatic displays. Eventually she did not stay with either, but ran off to a colony ten yards away in response to another apparently more glamorous male which was also displaying.

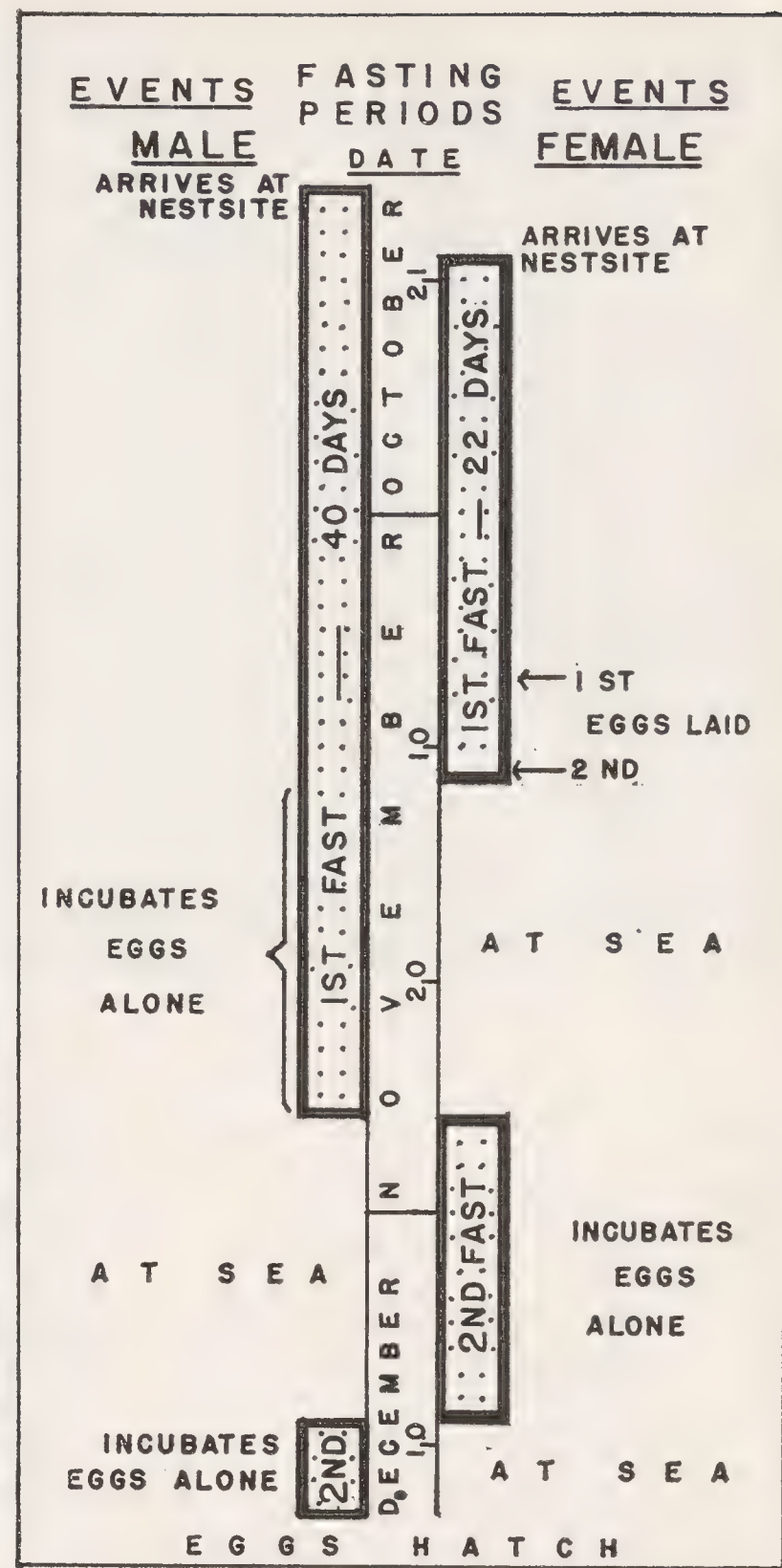
Fighting is frequent in the colonies, but usually the combatants are young birds, wandering among the more established penguins. With backs arched and breasts thrust well forward, they bump each other vigorously and strike blows with their flippers so rapidly that it is impossible to follow single movements.

The nests are built of stones. There is, in fact, no other suitable material in the Antarctic, for the few mosses and lichens that occur so far south cannot survive the trappings of many thousands of busy feet. What is the purpose of such a cold-looking nest? It is to raise the eggs and incubating bird above ground level. It may not be more than four to six inches high, but this might make all the difference when the blizzards come, or icy streams from melting snow flow around it. Collecting stones is shared by the pair. Each bird takes its turn to sit at the nest and guard the stones while the other walks off to collect more. The bird at the nest will arrange them, often lying down and scraping uncomfortable stones away with its feet. Adelies vary in their nest-building habits. Some individuals, to our eyes, are conscientious collectors of stones, walking far away from other nests to pick up stones in their beaks and bring them back to the mate. Others just lean backwards and steal a stone when a neighbor is looking another way. In this way stones get passed from nest to nest, from the outside edge of the colony towards the center.

The first eggs are found in the rookery during first week of November, between three and four weeks after the first birds trekked in over the sea ice. Two eggs are usually laid, occasionally one. Within about 24 hours the male has taken charge of them and the female has walked off to sea to

break her fast. At this time of the year the sea ice that had been so firm through the winter months and over which the birds had walked such a distance in October, begins to break up. The departing females may therefore be able to plunge straight into the sea if the ice has gone, or, in a less favorable year, they may have to walk at the most several miles, but never so far as they did at the beginning of the season. While his mate is away at sea feeding, the male incubates the eggs alone, and cannot leave the nest for even a stretch of his legs. If he should, the eggs would be stolen by either the white Sheathbill (*Chionis alba*), or the large brown gull-like Antarctic Skua (*Stercorarius skua*). The Sheathbill is slightly larger than a pigeon, and is a scavenger living among the breeding penguins. It pecks through the egg shell with ease, and eats the contents. The Skua swoops down and flies away with the egg in its bill. This is quite a feat, for the Adelie egg is about the size of a goose's egg and weighs about 4 ounces. The weather, however, accounts for many more casualties among the eggs than do the Skuas and Sheathbills. During my first year at Hope Bay when many thousands of birds were buried on their nests by the snow blizzards, I had to walk carefully in places for fear of opening up a little ice-cave, at the bottom of which would be a plucky Adelie protesting vigorously at my large boots. It was only when the snows started to melt away that I realized the damage done to the rookery. Cracked and frozen eggs were lying around everywhere. The Skuas and Sheathbills had far more than they could possibly eat.

When the female returns from the sea about two and a half weeks later, she finds her way to the nest with unerring accuracy, recognizes her mate from a distance and they greet each other with what is called the *mutual display*. Waving their heads from side to side, they make a lot of noise. The female is anxious to get on her eggs, but the male is reluctant to leave them after his long vigil — so the nest relief ceremony, or what is frequently called "changing the guard" may take from a few minutes to 10 or even 15. The male eventually steps off, allowing the female to settle on the eggs which she does quickly lest the Sheathbills or Skuas are around to steal them. After the male has collected stones to make up

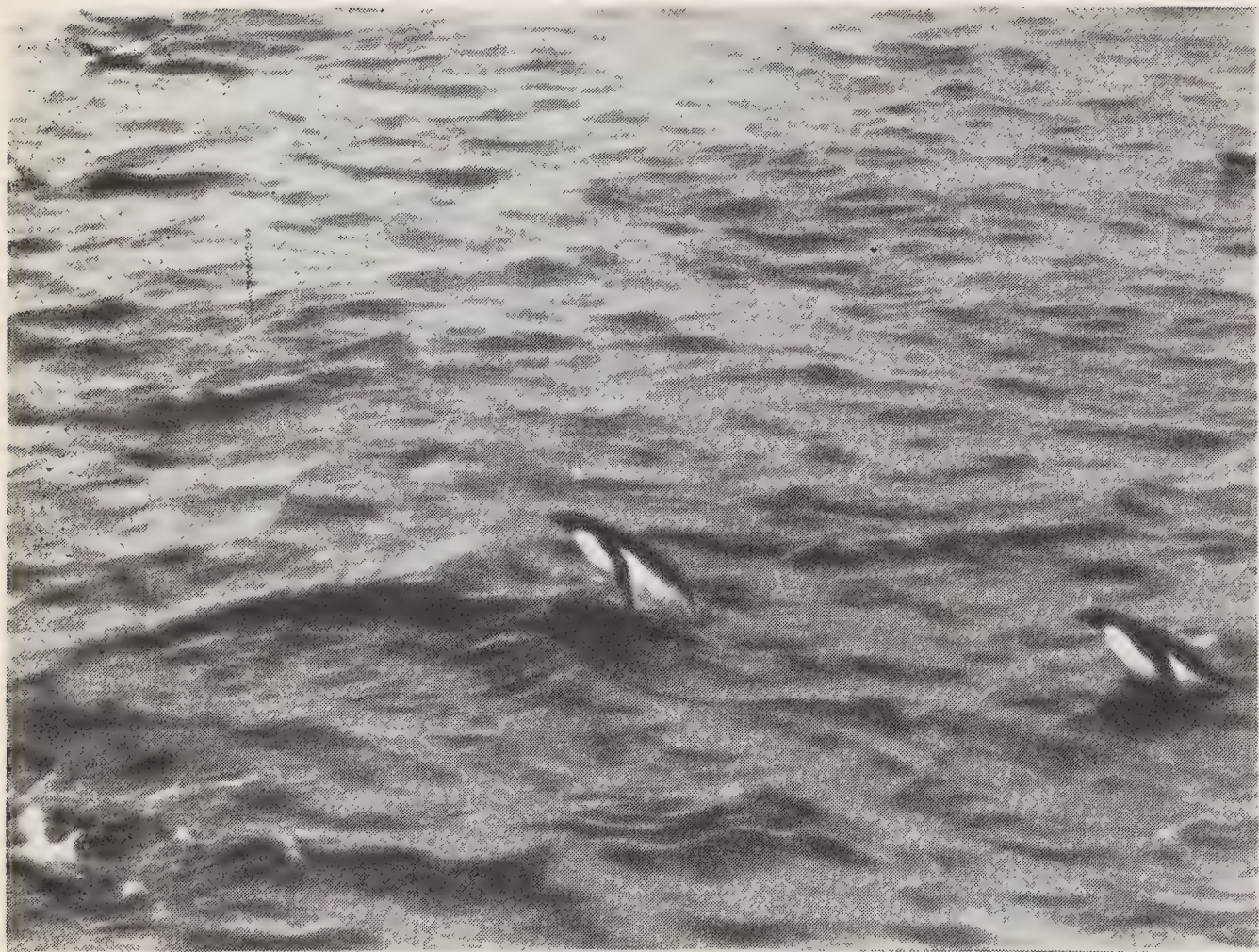


the nest to a more practical size (many having been stolen while he was alone), he will leave his mate and walk off to sea to end his own fast. He has had nothing to eat since he first arrived over the sea ice at the beginning of the Antarctic Spring. He spent about three and a half weeks at the colony with his mate before the eggs were laid and he has now completed a two and a half weeks' vigil alone over the eggs while she was feeding at sea. This makes a total fasting period of six weeks without a bite of food. His weight has decreased from about 14½ pounds to about 7¾ pounds, a loss of more than 40 per cent. As far as we know, this continuous fasting period of six weeks is exceeded only by the male Emperor Penguin (*Aptenodytes forsteri*), which fasts for about twice as long while incubating its single egg in the middle of the Antarctic winter. But the Emperor Penguin is a much larger bird than the Adelie. Its weight at the beginning of its fast is about seven times more. These two species of penguin which hold the record for the longest fasts are, interestingly, the two most polar birds. Their long fasting periods are adaptations to the

Left — A chick begs for food and the parent regurgitates semi-digested food from its stomach. Right — A diagram based on a typical life history, showing fasts of the Adelies.

conditions of snow and ice which surround them when they start their breeding seasons.

At sea penguins are truly wonderful performers and are quite definitely the best adapted of any birds to an aquatic life. Adelies swim for several yards under water and then surface. Barely rising as much as a foot, they vanish underneath again a few feet ahead. This *porpoising* is the penguin's normal way of swimming and is used by no other kinds of birds. At normal speed they probably porpoise-swim at 10 miles an hour, but when hard pressed their speed has been estimated to be up to 30 miles an hour. Under the surface they shoot along like little torpedoes, propelling themselves with their flippers, their feet sticking out behind and working with the tail as a rudder. When coming in to land you can see their heads lifted out of the water about twenty yards off-shore as though they were summing up the



returns to the nest after his spell at sea. By this time he is in beautiful condition and well nourished. His return allows the female to get away to sea again and when she comes back the eggs will be hatched or hatching. She will have semi-digested food in her stomach for the chicks, which she feeds by regurgitation. Rearing the chicks is shared by both parents, one guarding the chicks and feeding them, while the other is away at sea collecting more food. The parents change over at intervals of one or two days with the same nest relief ceremonies as they performed during the incubation period. This period is known as the guard stage, but when the chicks are about half grown, five weeks after they hatched, they are left alone. Both parents are now away at sea for

Porpoising is the Adelies' normal way of swimming at sea. Normally they travel at about 10 miles an hour but when hard-pressed their speed has been estimated at three times that.

Adelies coming in from sea are leaping almost straight up to land on the edge of the ice. The height of the leap is 6 feet, perhaps 7.



landing place. Then no more is seen of them until they suddenly pop out of the water one by one onto the ice. Sometimes they land erect and balanced by their long tails, run forward and pull up sharply. At other times, still landing on their feet, they fall onto their bellies and toboggan along the surface in a most enchanting manner.

The incubation period lasts about 35 days. Some days before the two eggs hatch the male

most of the time and come back only for short spells to feed their young. When the chicks are left alone they band together in large groups, called crèches, of up to 100 or 200 chicks. This habit is mostly for protection from the Skuas. Previously it was believed that upon their return from sea with food a parent would feed any chicks from this mass, on a first-come-first-served basis. But by marking the family units before the chicks went into the crèches, I was surprised,

and delighted, to discover that the parents recognized and fed their own offspring, and only under exceptional circumstances fed strangers. I believe that these penguins can recognize each others' features, gait, movements and voices. The mutual display or "greeting" seen so frequently between two of a pair, and between parents and chicks at the nest relief ceremony, is later seen when a parent comes back to feed its young at the crèche. The noise and movements of this greeting ceremony appear to serve an important function in the Adelie Penguin in confirming as well as re-inforcing recognition. More work needs to be done on the displays and noises of penguins in relation to individual recognition, and this is a challenge to future biologists.

Recording sounds of penguins in the Antarctic presented a number of problems. The recordings for the film were mostly made in 1950 in the South Orkneys. The penguins were two and a half miles away from our base hut and the apparatus was too delicate to transport over rough country by sled, so it had to come in our little 8-foot dinghy, on a calm day. A wire recorder powered by a large automobile battery had to be kept in the observation tent, a considerable addition to the congestion of food, sleeping bag, photographic apparatus and so on. At one time even a husky bitch was there having her litter of six pups! The spool of recording wire would last an hour, but working single-handed made it difficult to keep an eye on the controls as well as to make notes on the penguins that were being recorded. Sometimes the machine would run slowly because of the cold, or the wire got so tangled that it was impossible to unravel it. Unexpected opposition came from the penguins. One looked at the microphone most suspiciously, and not knowing what to do, gave it a sharp jab with its bill. Another eyed the microphone lead eagerly, picked it up, no doubt considering it excellent nest material, and walked off with it proudly, but of course it tripped up after a few steps. After that it went off meekly to collect the more commonplace stones.

Elephant Seals often come ashore and lie among the penguins. This is a Chinstrap Penguin and its chick. There is nothing much the Penguins can do except keep out of the way.

When living among the penguins, one soon begins to feel for them when they are in difficulties. Any account of their life history would be incomplete without some records of their enemies and other causes of mortality. I was able to photograph the three major ones, the Skua, bad weather and the Leopard Seal (*Hydrurga leptonyx*), and also the Elephant Seal (*Mirounga leonina*), which was really little more than a nuisance to the penguins. The Skua is hatching its own young nearby when the Adelie chicks are grouping together into the crèches and there can be no doubt that they take a heavy toll. Adult penguins are not attacked. Chicks are attacked when separated from the crèches and are often tugged away from them by the legs. An alert chick will stumble back and resist further aggression, but those which allow themselves to be repeatedly dragged out will soon be killed. I filmed a weak, starving chick, probably deserted by its parents, in danger from this predator. It was separated from the crèche but facing up to the Skua and displaying threateningly, actually hitting back and making the Skua withdraw. Not until another Skua floored the weakling did it turn its back on them and rush to comparative safety in the nearby crèche. During my studies I was constantly impressed by the fact that these predators, almost without exception, attacked the



weak and stupid chicks only. Natural selection goes on all the time; only the toughest penguins survive.

Weather was probably the worst enemy. One of the features of Antarctic weather is its extreme changeability and year-round harshness. The Arctic has reasonably high temperatures in the summer months, but in the Antarctic the temperature will rarely rise much above freezing and will often stay much lower. Low temperature does not seem to worry the adult birds — nor does anything on land, for that matter — but it does have an indirect effect on the eggs and young. Where the Antarctic Ocean surrounds their breeding islands, high seas may be responsible for casualties among the adults late in the season. In one spectacular scene we see an adult Adelie picked up by gigantic waves and hurled three times against a vertical rock. I was lucky to get this sequence because spray from the waves was flying everywhere and the wind was so strong that I had to put the whole of my weight on the shortened tripod to keep the camera steady. As the camera motor turned and the bird struggled to get in I hoped it would land and not be smashed. It made it just before the clockwork motor ran down. When it eventually landed it looked none the worse for its ordeal and walked straight up to the rookery to feed its young.

Elephant Seals, so called because the adult male has a nasal proboscis, do not attack the penguins at sea nor even on land, but like to lie around in stinking wallows and to rub against boulders. Or, as I found out one morning, up against my laboratory tent! Males may weigh as much as three tons, and if they choose to lie alongside a nesting penguin there is very little a penguin can do, but to bravely stand its ground and maybe give the seal a peck in the nose (as is shown in the film). Occasionally a seal might roll over without noticing the penguins. The adults will then leap away, but the eggs or young chicks will be flattened.

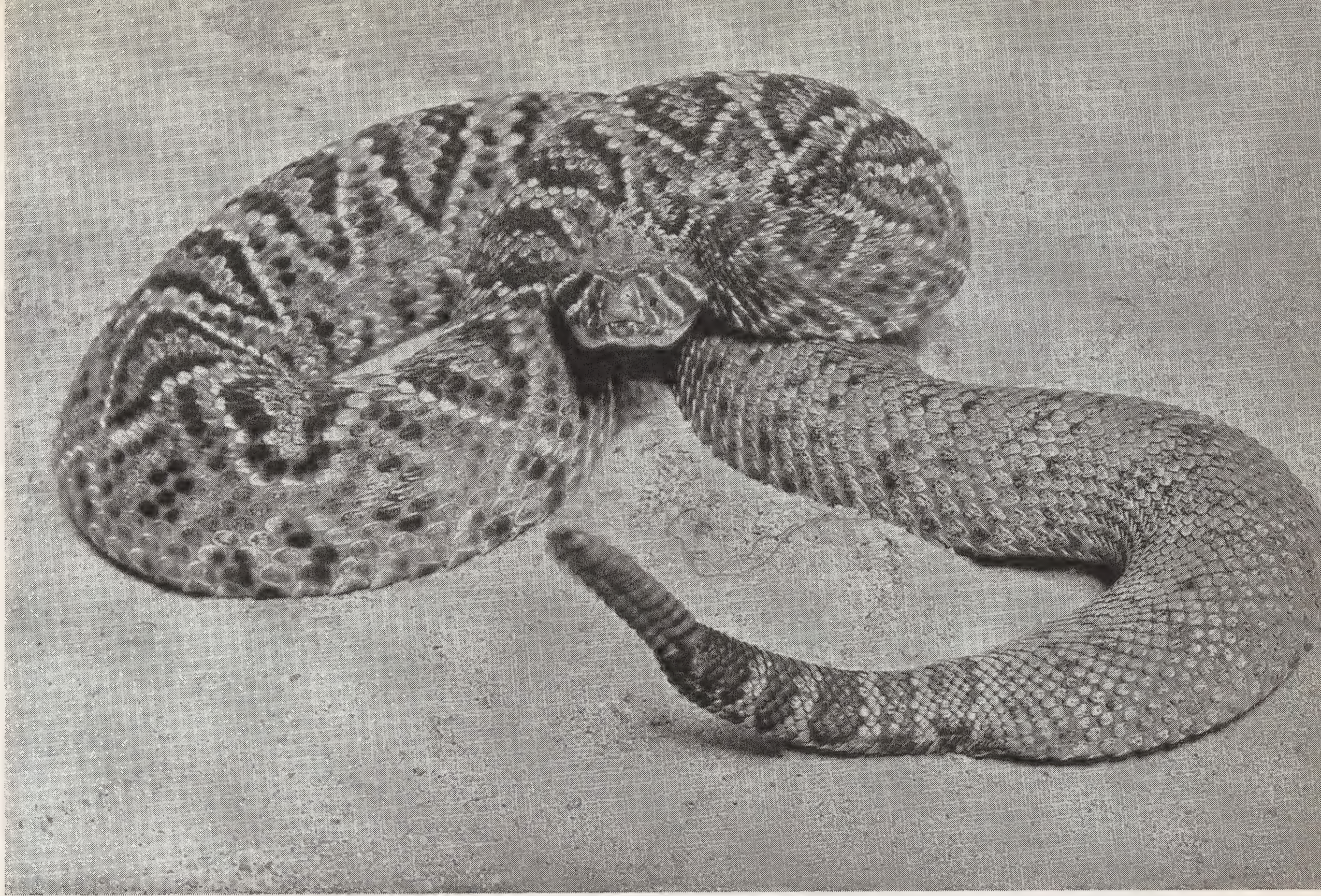
In contrast to the Elephant Seal, the Leopard Seal has a black record. When the chicks are about six weeks old their black-and-white immature plumage starts to push off the dark fluffy down. At nine weeks they are as large as their parents and looking smart and chic, although per-

haps a little tuft of down still clings to the tops of their heads or backs of their flippers. The parents desert them, and after a day or two the chicks leave the colonies and congregate along the water's edge where they have so many times seen the adults departing for the pack ice. Then for the very first time, and after much preliminary excitement and noise, they plunge into the water, quite independently of their parents, and with no preliminary lessons from them. Lurking in wait for these unsuspecting youngsters is the Leopard Seal. With a quick flash of the seal's head the chick is skinned alive and swallowed. Even the skin may be gulped down later if the seal is hungry enough. From the records at present available it appears that the largest numbers of penguins are killed in this way at a time of the season when the young penguins are leaving the rookeries. So predation by the Leopard Seal, like predation by the Skua, might well be selective, a healthy, alert adult Adelie being able to ward off an attack or to outmaneuver a seal, unless caught unaware.

No doubt the numbers of young leaving the colonies in mid-February are thinned out by the Leopard Seals, but plenty will reach the feeding grounds in the pack ice where they will rejoin the adults and soon be feeding for themselves. Here in the pack ice at the edge of open water, the Adelie Penguins remain during the long Antarctic winter. Far from land they feed, sleep and quarrel, and here the young Adelies of the past breeding season come to adulthood.

Wintry winds sweep across the breeding grounds and the expedition base. Only men and dogs and a few Sheathbills remain, sure in their knowledge that when spring comes the Adelie Penguins will return.

I am frequently made aware that serious biological study does not spoil the fun and excitement of watching wildlife. The deeper understanding it brings will always multiply appreciation. To be able to transmit the understanding to other people is to use one of the strongest weapons for protecting wildlife from the ever-increasing encroachment of man. We hope this short film will give just a small glimpse of the wonderful unspoilt life of the Antarctic, which it is as much our duty to protect as it is to preserve the beautiful places nearer home.



*What Do You Want to
Know about Rattlesnakes? It's In —*

Klauber's Rattlesnake Book

By JAMES A. OLIVER

The Eastern Diamondback is the largest rattlesnake. Eight-foot specimens, "give or take an inch or so," are quite rare, however.

RATTLESNAKES are strictly an American phenomenon, yet today they are so well-known outside the Western Hemisphere that all major European languages have a word for them. In Germany naturalists know the *Klapperschlange*, in France they call it *Serpent á sonnettes*, the Spaniards term it *Cascabel* and the Russians simply say Гремучая змея. In any language the unique appendage on the tail gives these snakes their name. This appendage also is largely responsible for the fame and much of the folklore of the rattlesnakes.

The earliest published reference to a rattlesnake was made by Pedro de Cieça de Leon in his *Chronica del Peru*, published in 1554. During the 400 years since that date a great deal has been written and said about these remarkable snakes. Much that has been reported is true, but a great deal is not — and nobody knows this better than Laurence M. Klauber, an engineer by profession, who has made a full-time avocation of studying rattlesnakes and has become the leading authority on the group. He started his reptile studies in 1921 and has been consulting



The Sidewinder's habitat is the arid, sandy, southwestern United States and northern Mexico. It is often called the "Horned Rattler" because of the head scales.

The only species of rattlesnake in continental South America is this one. It has the deadliest venom that affects the nervous system.



Curator of Reptiles at the San Diego Zoo for the past 35 years. During this time he has amassed a tremendous amount of information based on first-hand experience with more than 12,000 rattlers in the field, in the zoo and in his home laboratory. He has made an exhaustive search of the literature, sorting out all observations, reports, chronicles and folklore relating to rattlesnakes. The culmination of Klauber's herpetological career came on October 22, 1956, with the publication of his two-volume work, "Rattlesnakes — Their Habits, Life Histories, and Influence on Mankind." This was published by the University of California Press, Berkeley 4, California under the auspices of the Zoological Society of San Diego. The two volumes contain 1530 pages with 238 illustrations and sell for \$17.50.

Without question this is the most thorough and scholarly study ever made of any group of reptiles. It is a compendium of everything that is scientifically known about rattlesnakes and it is presented in a clear and lively style. Although it is not intended to be a popular natural history, many sections will appeal to anyone interested in the outdoors and particular chapters will be "required reading" for physicians, ethnologists and folklorists.

Klauber recognizes 30 species and 65 subspecies or races of rattlesnakes, assigned to two genera. They occur from southern Canada to northern Argentina. In fact, the larger of the two genera, *Crotalus* (*Sistrurus* is the other), actually has this extreme distribution — the greatest of any genus of reptiles in the Western Hemi-

sphere. In the United States at least one species is found in every state except Maine and Delaware, and even in these the Timber Rattlesnake formerly inhabited small areas. Elsewhere local eradication has affected many species in industrial and agricultural areas. For instance, the last rattlesnake known on Long Island was killed near Centre Islip in 1903. Arizona is the headquarters for rattlesnakes in the United States with eleven species occurring within its boundaries. Mexico, however, is the continental center of the group and no less than 26 species are found within its political boundaries, including Baja California and the coastal islands.

Rattlesnakes occur in almost every type of habitat found in the United States and Mexico, from coast to coast and from sea level to elevations of 14,500 feet in Mexico and 11,000 in the western United States. They occur as high on mountains and as far north and south as the length and warmth of the warm season permit young to be brought to full development within at most a two-year cycle. The greatest number of species occurs in the highlands of the Mexican Plateau. Some are restricted to mountainous uplands, whereas others occur over a wide altitudinal range. Some forms, like the Sidewinder Rattlesnake, are characteristically found in and around sandy areas; some such as the Rock Rattlers are found, as their name implies, on rocky uplands; still others, like the Black-tailed Rattlers and the

Timber Rattlers, more often occur in wooded regions. In general more species occupy dry than moist areas and humidity appears to be more of a barrier to the species than aridity. Klauber says that species having the greatest geographic ranges are those that prefer, in at least a part of their ranges, rocky hillsides or mountains with a scant brush cover.

Rattlesnakes vary in size from small species that never reach a length of two feet to the giants of the group, the Eastern and Western Diamondback Rattlers, which occasionally exceed seven feet in length. In characteristic scholarly and critical fashion Klauber examines the reports of the maximum length of the Eastern Diamondback, the largest of the rattlesnakes. He sifts carefully through the claims for eight- and nine-foot individuals and finds them based usually on uncritical measurements or measured skins (which are always stretched, since it is impossible to remove a snake's skin without stretching it). He concludes that "very rarely the Eastern Diamondback does measure 8 feet (2,438 mm.), give or take an inch or so." Then he calculates the theoretical frequency of occurrence of such a rare giant and finds that one out of 31,000 specimens might grow to such size. He emphasizes the fact that these figures are highly speculative, but they do give an indication of the possibilities of seeing a rattler of maximum length.

An interesting section is devoted to a discussion



Rocky uplands are a home of the Mottled Rock Rattlesnake of the Mexican Plateau and the Arizona highlands. This is an unusually large one, about 2 feet.

of the rattle, from which the group gets its name and about which there is a great deal of misinformation. This horny, segmented structure is composed of keratin, the albumenoid substance that is the basic material in horn, nails, hair and feathers. Contrary to a widespread folk belief you cannot tell the age of a rattlesnake by the number of segments in the rattle. A new segment is added each time the snake sheds its skin. In the wild young rattlers may shed two to four times in their first full growing season and one to four times in the second. From then on the frequency of shedding tends to decrease to a minimum of once a year. In captivity the frequency of shedding is usually greater than in the wild because the snakes do not hibernate during the winter months. The maximum number of sheddings reported in a year in captive rattlesnakes was seven. Thus it will be seen that a rattlesnake may add anywhere from one to seven segments to the rattle in a single year.

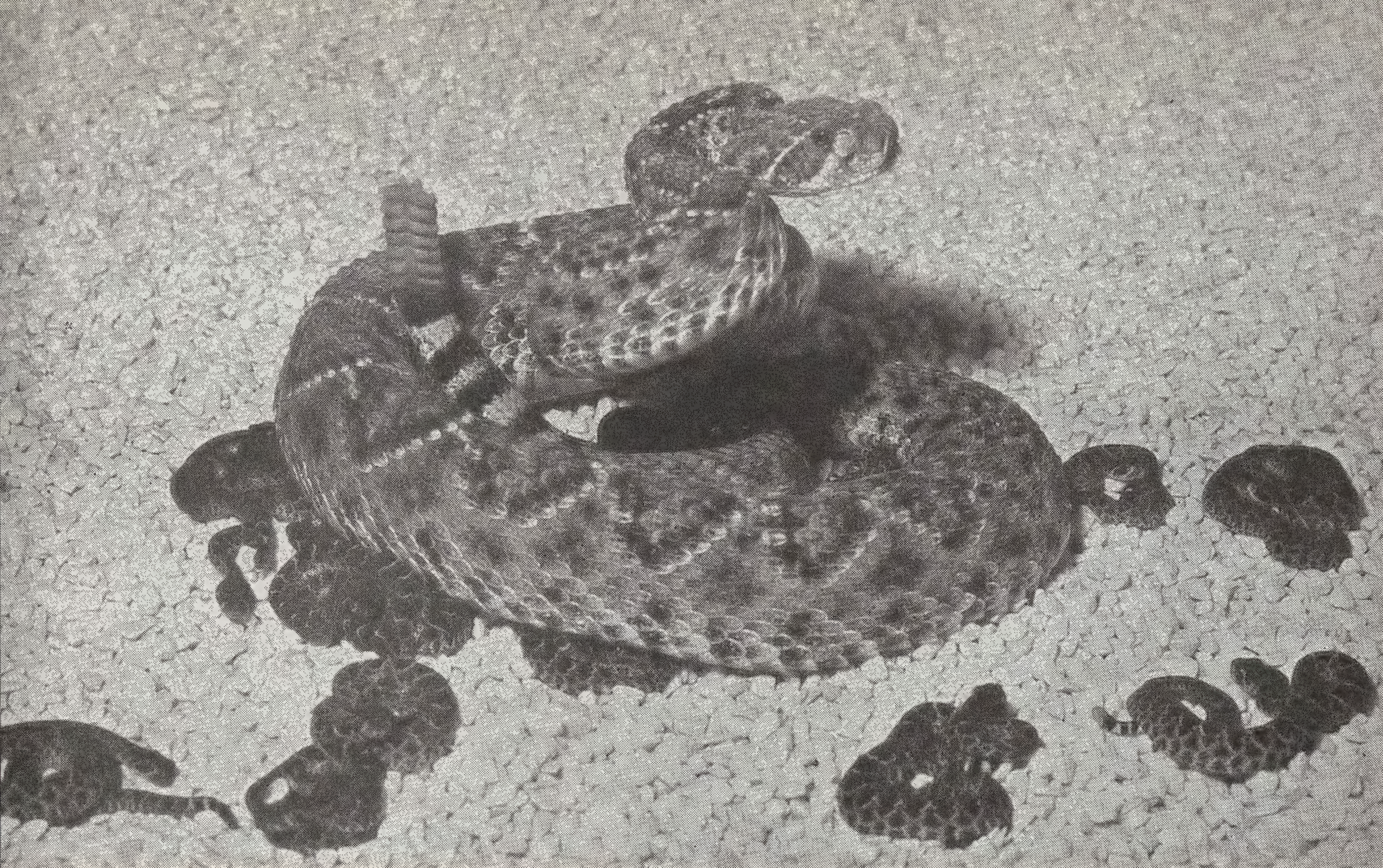
Another thing that makes it difficult or impossible to determine the age of a snake by the number of rattles it carries is the fragility of the rattle. As soon as the rattle gets very long it can be broken easily and is more subjected to wear. For this reason few adult rattlers carry unbroken rattles. Here again captive specimens have the edge on their wild relatives — partly because they tend to become tame and do not use their rattles, and there is less danger of breakage and less wear. Also they add new segments more frequently. The longest rattles recorded by Klauber on wild snakes were an incomplete set of 23 segments on a Western Diamondback and a complete set of 17 segments on an Eastern Diamondback. These long sets are contrasted with exceptionally long rattles on captive snakes — an incomplete rattle with 29 segments on a Timber Rattler and a complete set of 18 segments on a Tortuga Island Rattler, both in the San Diego Zoo.

Great interest has attached to unusually long rattles because of the notion that they indicated great age and hence great size. Thus many stories relate to adventurous encounters with and the slaying of rattlers that had strings of 40 or more rattles. So prevalent is this idea that long rattles have been made artificially — both on living snakes and on detached rattles. With a little care and skill quite authentic-looking rattles can

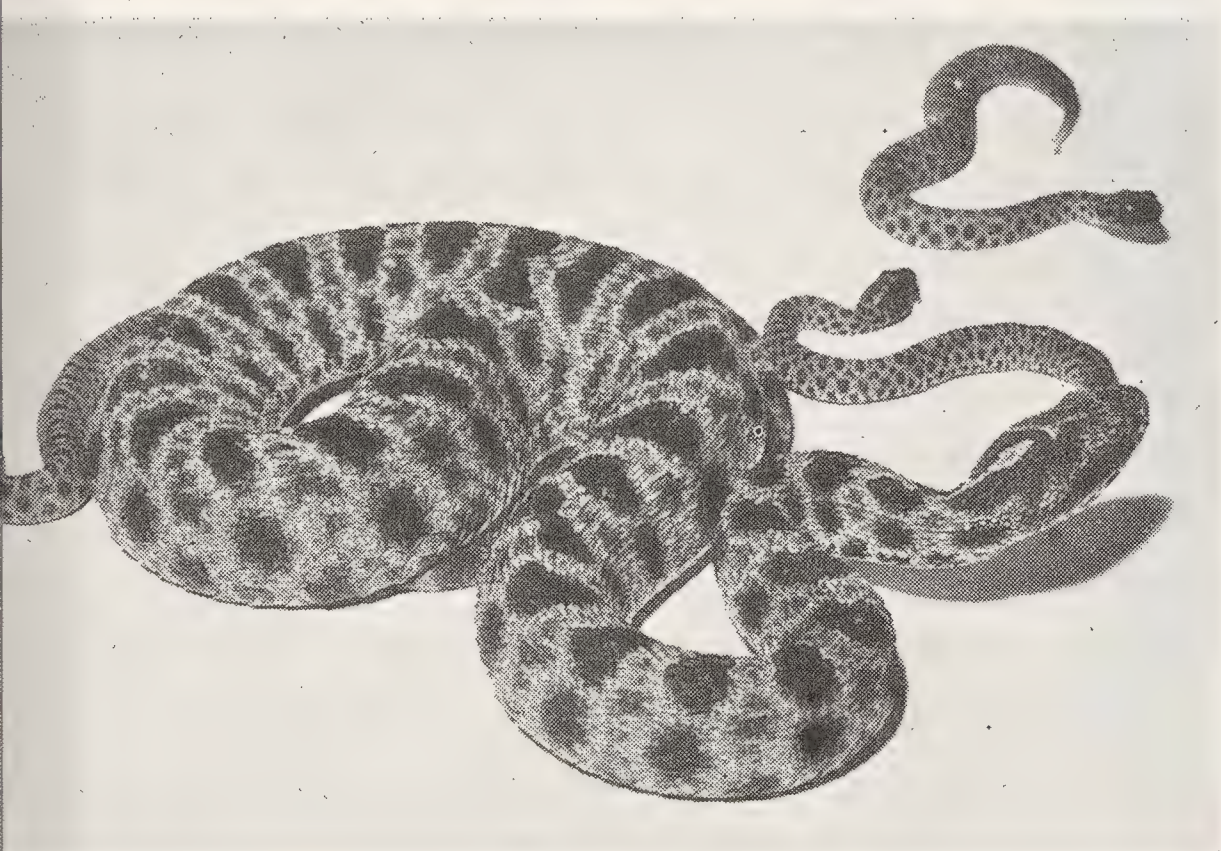
be made, giving the erroneous impression of great age.

Much speculation has been devoted to the function of the rattle. According to these theories, it is a poisonous weapon; its sound is a mating call; its sound charms prey; its sound lures prey; its sound is a warning to other snakes; and so on. Klauber reviews all of these and gets down to the real controversy over the purpose of the rattle — its use as a warning. The theory of the rattle as a warning is an old one, going back to the 17th century, and one that has been widely debated. Klauber carefully reviews all of the arguments for and against this theory and shows where much of the misunderstanding arose between proponents and opponents of this view. He makes clear that according to this theory the rattle is used as a warning or threat to creatures that might do it harm — not a warning to prey nor an altruistic warning of an intruder for the intruder's protection. Incidentally, if there is anyone around who still believes rattlesnakes are chivalrous creatures that always warn before they strike, they would do well to abandon this notion. Frequently the snakes strike and then rattle, or they may not rattle at all. The warning does not invariably prove effective and sometimes works to the detriment of the snake. However, there is ample proof that in most cases it serves as a useful warning device.

When the warning sound of the rattle fails to drive off the intruder the rattlesnake can rely on its fangs and venom. Within any species there is considerable individual variation in temperament, but there are differences among species. Some, for example, are more nervous and excitable than others. Most herpetologists will agree with Klauber in rating the Western Diamondback Rattlesnake as the most excitable and quickest to strike. Readers of *ANIMAL KINGDOM* will recall from Henry Lester's article, "How We Photographed A Rattlesnake's Strike," that here in the New York Zoological Park we selected the Western Diamondback to work with for this reason. Despite the bad reputation of this species, we had to test two dozen snakes before we found one that was as excitable as we required. This was Herman, "the toughest Texan of them all," a snake now immortalized in a high speed colored film of a rattlesnake's strike.



Dr. Klauber doubted the identification of this snake, which produced 46 young. It is, however, a Western Diamondback Rattler.



One of the smallest rattlers is the Carolina Pigmy Rattlesnake which does not attain a length of 2 feet; 20 inches is average.

The Eastern Diamondback Rattlesnake is rated a close second to its western cousin. Some snake men would rate it first and argue against having it placed anywhere but at the top. Any such rating is highly subjective and prone to personal bias. Individuals of either species can be persistently irascible and dangerous, but in my own experience I have met more "docile" Eastern than Western Diamondbacks. Some species of rattlesnakes are characteristically quite mild-mannered and must be treated roughly to induce them to either rattle or strike. The Red Diamond Rattlesnake probably is the species best known for its inoffensive nature, although some of the smaller forms appear to be of similar disposition and temperament.

Rattlesnakes feed mostly on small mammals, particularly rodents, such as mice, rats, prairie dogs, gophers and ground squirrels. Some of the smaller species, as well as the young of a few larger ones, feed to a considerable extent on lizards. Occasionally frogs and birds augment these basic diets. Rattlesnakes, like all other snakes, do not eat vegetable food. Usually only food struck and killed by the snake is eaten, but sometimes animals already dead are taken. Klauber calculates that an adequate meal every 14 to 18 days will keep captive adult rattlesnakes in good health. He states that in the wild, where they are more active, and in the case of growing young, more frequent meals may be necessary. He points out the great ability of snakes to undergo prolonged fasts between meals. We have no way of getting accurate figures on this in wild individuals and must rely on data from captive specimens.

Klauber cites reliable records of rattlesnakes in captivity fasting for up to two years, and he lists specific records from the San Diego Zoo collection of fasts from 16 to 23 months. Of course, these snakes all had water to drink.

Because of their nervous nature, rattlesnakes are among the most difficult snakes to feed successfully in captivity. Minor disturbances may upset them and cause them to stop eating, even though they have been feeding regularly for months. As an illustration of this, we have a half-grown Eastern Diamondback Rattlesnake we have been raising in the Reptile House. In its cage the snake has a little wooden box that serves as its retreat and in which it rests most of the day. If we remove this box, the snake immediately stops eating. Our problem is to get him to eat without his little box; otherwise, when we put him on exhibition, all our visitors will see is a snake's head peering out of a small wooden box — not much of a display.

All rattlesnakes give birth to living young. The size of litters varies from 1 to 60. The Central American Rattlesnake and Mexican West-coast Rattlesnake are generally the most prolific. In the United States, Klauber cites the Timber Rattlesnake as the most prolific with a recorded maximum of 30. The next highest maximum is 24 credited to the Western Diamondback Rattlesnake. However, in the text Klauber refers to two exceptionally large broods reported in the literature for this species, but not included in the table on size of broods. He questions the validity of these exceptional broods, suggesting, "There may have been confusion with the prolific Mexican West-coast Rattler." One of these record reports is of interest to us here at the New York Zoological Park because it was made by William Bridges for a female in our collection at the time. This snake gave birth to a brood of 46 young, 26 alive and 20 dead. Fortunately, our Staff Photographer Sam Dunton trained his camera on the mother and part of her brood, so we can verify the accuracy of the identification; the female was a Western Diamondback Rattlesnake. There is a general tendency within a species for the larger females to have larger broods than the smaller ones. This female was definitely an exception to the rule, since she was not unusually large.

Klauber next turns his attention to a detailed

consideration of the venom apparatus, the venom, snakebite and its importance. These sections will be of great value to everyone interested in the out-of-doors. This is one of the clearest and most conservative expositions of our present knowledge of these topics. He carefully indicates the variable factors involved in considering the gravity of snakebite — an exaggerated medical problem but nonetheless important to a victim of snakebite. The toxicity of rattlesnake venom varies tremendously from species to species, with some venoms being many times stronger than others. There are species of rattlesnakes that never inflict a bite fatal to human beings, whereas the bites of others, while not always fatal, are dangerous. After evaluating the incompleteness of the available figures, Klauber reports that of the 1,500,000 annual deaths in the United States, only 50 are due to venomous animals, including snakes. This is a small number in comparison with the truly tragic toll of life on our highways.

The remaining sections of the book describe the many other ways in which rattlesnakes have made an important impact on mankind. Fascinating accounts are given of the role of the rattlesnake in the lives of the different Indian tribes of the Western Hemisphere. Then a review is presented of early post-Columbian knowledge of rattlesnakes. Here we find the origin of many of our folkbeliefs and myths about snakes. These are all carefully reviewed and evaluated. Here we are reminded of the importance of the rattlesnake as an early symbol of the restless colonies, eager to throw off dependence on Mother England. Sometimes, as Klauber points out, the virtues attributed to the rattlesnake by colonial patriots were undeserved. He could find no support of the belief that Benjamin Franklin advocated the rattlesnake as the national emblem in place of the eagle. Considering the popular attitude towards snakes, it is just as well that the eagle was adopted for this purpose. Nonetheless, the rattlesnake emblem and motto, "Don't Tread On Me," was a popular one.

It is impossible in such limited space to give even an outline of the wide scope or a hint of the rich flavor of this wonderful work. Dr. Klauber has done a splendid job and greatly enriched our knowledge of one of the most fascinating, but often misunderstood, groups of reptiles.

ZOO NEWS IN PICTURES

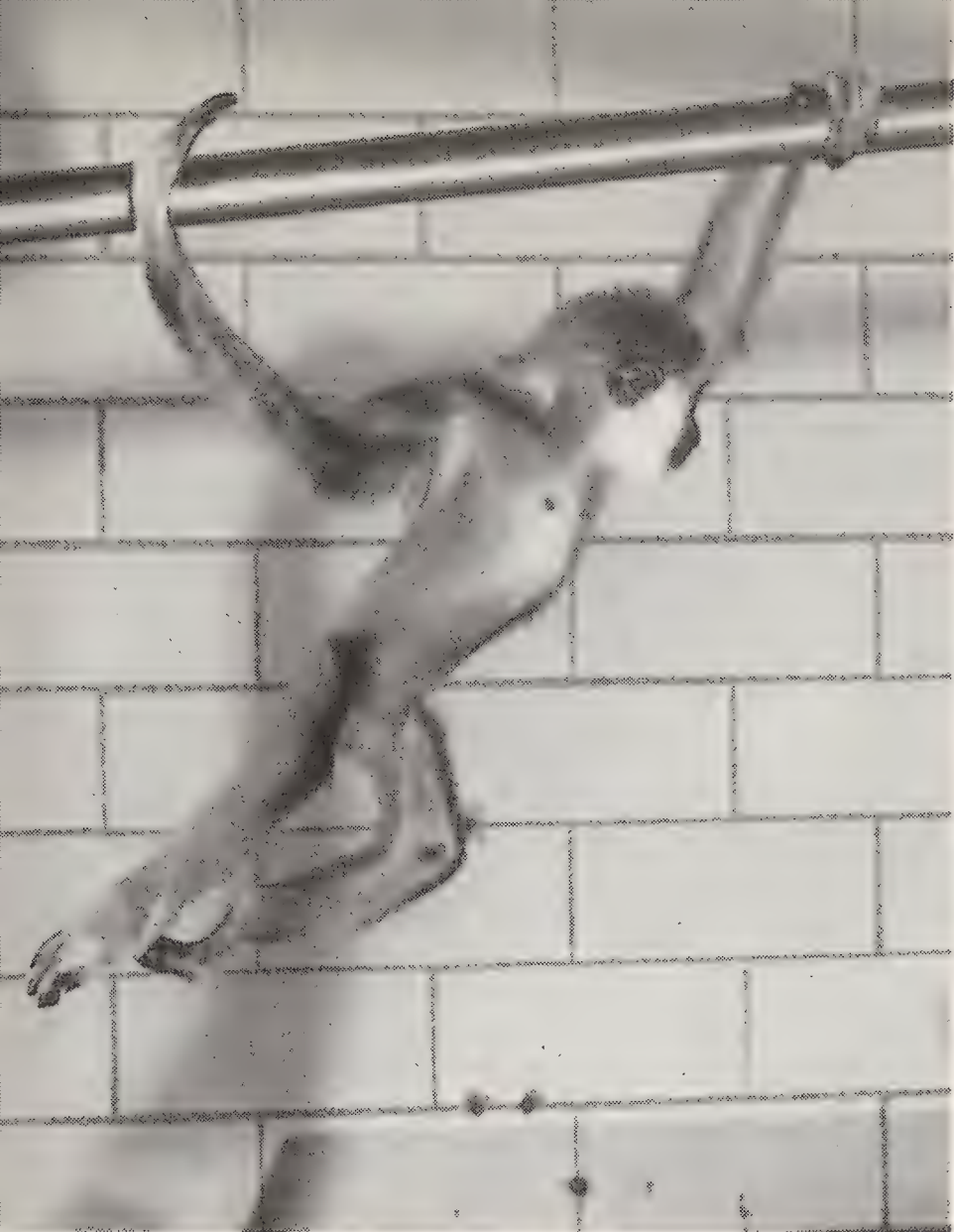
Photographs by SAM DUNTON

Lassitude and laziness are familiar manifestations of spring, and accordingly the picture on the right belongs on this page. A **HARBOR SEAL** (asleep on the ledge) and a **GRAY SEAL** (balanced on its back) certainly illustrate lassitude and laziness. The trouble is, seals are apt to be that way the year around; this photograph was made on a cold February day. On the other hand, the cock **OSTRICH** (below, left) in abandoned pursuit of a hen Ostrich, does legitimately represent springtime on the African Plains. The cock came to us last year as a very young bird, but the hen is a rather savage one we have had for some years. The way things look now, we can be optimistic about rearing young Ostriches.

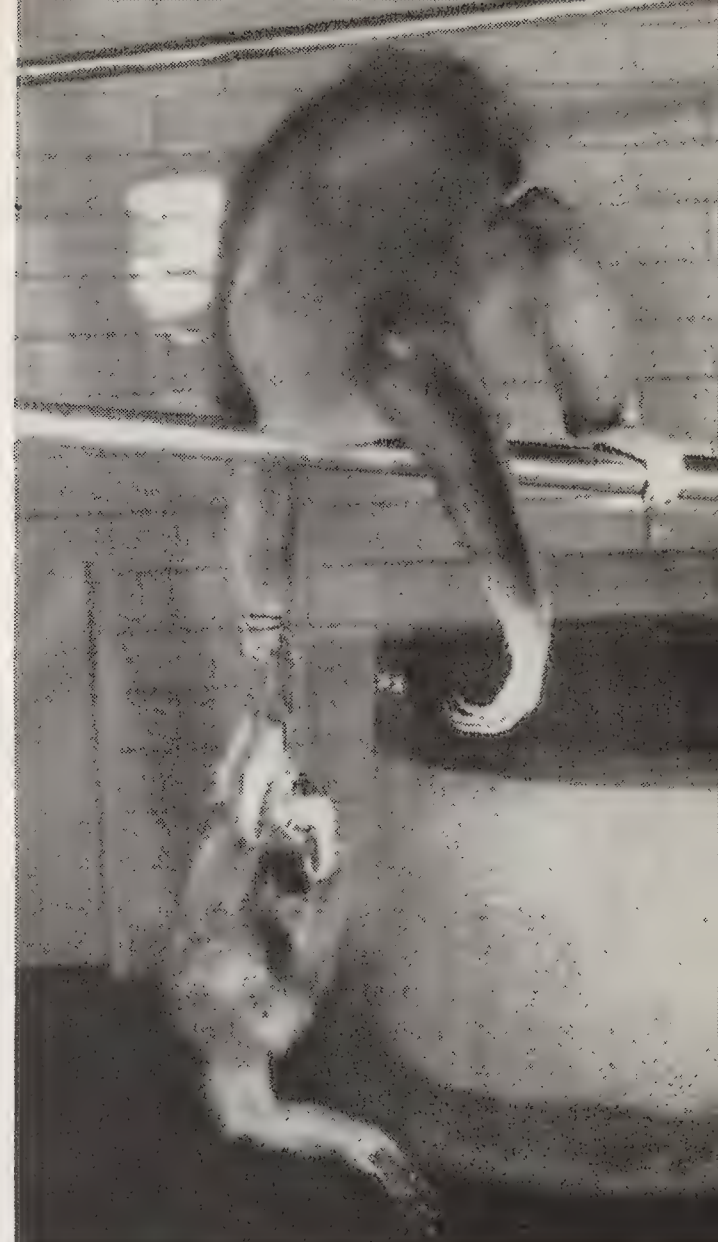




These roly-poly puppies may seem to be a little out of place in a collection of wild animals, but they aren't, for they are young **DINGOS**, also known as **AUSTRALIAN WILD DOGS**. The youngsters were born on December 23 and were just six weeks old when this photograph was taken. They are extremely shy and are inclined to run to the farthest corner of their yard when their keeper enters. Nevertheless, in Australia Dingos are sometimes kept by the aborigines as semi-tame hunting dogs. They hybridize with domestic dogs and one variety of Australian sheep dog is supposed to have Dingo blood. We have hand-reared a few Dingo puppies born here in the past, and they have been delightful pets while they were quite young. Sooner or later, however, they become untrustworthy as pets.



The best show in the Zoo right now is being put on by our family group of **WHITE-HANDED GIBBONS** in the Great Apes House. Junior, the youngest member, was born on December 29, 1955, and for the past few weeks has been big enough and strong enough to emulate the elders and swing on the bars — generally being pursued by one of the grown-ups. They often seem to play a game, a kind of “tag.” Junior is the sixth baby born to our pair. The whole family will spend the summer together on Gibbon Island in the Bronx River. They will be liberated on the island probably on June 1, depending of course on good weather at that time.



CHESTNUT DUIKERS from the Belgian Congo are rather rare in zoological collections, so we are all the more pleased at the breeding record of our pair. The female, shown here with her latest offspring, born February 13, is a member of the original pair brought to us by Charles Cordier in June of 1949. We have three other specimens, all born here. The female has proved to be an excellent mother and often assumes this protective pose, standing over her baby.



For another week or so it may be possible to see this little head projecting from the pouch of the female **AGILE WALLABY** in the Kangaroo House, but after that time Joey is probably going to be too big to take shelter. It was first seen in the pouch on November 23. In recent weeks it has often been out, but anything out of the ordinary causes it to pop back in. Its sex is unknown.



Pileated Woodpecker

KING OF THE WOODS

By WILLIAM G. CONWAY

scendo of wild notes confirmed the reality of my eyes' brief image. "King of the Woods, Stump Breaker, Log Cock, Indian Hen" are only a few of Pileated's colloquial names, attesting to its firm place in our native folklore.

Our most spectacular native forest bird, the Pileated Woodpecker is a solemn reminder of the splendor which we might once have seen surpassed by the Ivorybill but now knows no peer. Taxonomists divide the species into a number of regional races; *Dryocopus pileatus abieticola* (Bangs) is native in the New York area as well as the regions covered in this article. The species, as a whole, ranges from Nova Scotia and Canada to Florida, the Gulf Coast, and west to Texas. Pileateds are not found in the southern Rockies but do range from central California north. Occasionally, one of the huge woodpeckers will measure as much as nineteen inches in length, but the average is seventeen inches, not far behind the probably extinct Ivorybill's twenty-inch mean. While not comparable to Mexico's magnificent, rare Imperial Woodpecker, which may exceed 22 inches in length, the Pileated is among the world's largest and finest woodpeckers. Never easy to maintain in captivity, we did not display a Pileated until January, 1956, when an injured female was donated. While both sexes have brilliant red crests, the female's does not cover her forehead. Males are further distinguished by red streaks on either side of the lower mandible.

My association with Pileateds began many years ago with the accidental discovery of a tall, dead stub, some twenty inches in diameter, rising

SEARCHING CAREFULLY through the forest among trees standing like pillars in some ageless temple, supporting their dense roof of green, I was awed by the hushed feeling of suspense. My eyes suddenly fell on a scattering of wood chips at the base of an ancient poplar. Their size could mean only one thing — Pileateds! An upward glance revealed the quarry, as two startling patches of red and sharply contrasting black and white pitched out silently from a dark nest hole and disappeared with ghost-like abruptness into the quiet forest. An eerie, echoing cre-

in bottomland forest near Missouri's Merrimac River. Drenching humidity, stifling heat, and hordes of mosquitoes are integral parts of a May birding trip in Missouri's lowlands. In the excitement of my find, these discomforts were easily forgotten. Moving quietly as possible, I circled the tree and found, on the east side, a nest hole through which a man might wedge his fist. This entrance measured sixteen feet ten inches from the ground. After sitting quietly for a while and seeing no activity, I approached the tree and tapped it gently. No results. Assuming the nest was either abandoned or temporarily unoccupied, I set camera and notebook down and started shin-nying up the tree trunk. When nearly to my goal, a female Pileated literally exploded from the nest hole only inches above my head. The mosquitoes gave me little time in which to gawk foolishly so I slipped an arm down into the nest, slightly beyond my elbow, to feel three surprisingly small, smooth, warm eggs. A tremulous grasp of one egg with the tips of my fingers enabled me to draw it carefully out. Pointed at one end, white, with a thin, hard, shiny shell, the egg measured nearly an inch and a half long. The shell was translucent enough to allow the white air cell and the shadowy pink image of the developing embryo to be seen. Familiar with embryonic developmental stages in zoo pheasants and waterfowl, I hazarded a guess, which subsequently proved correct, that the eggs had been incubated about four days of the eighteen-day incubation period. Later I had the pleasure of seeing all three young woodpeckers successfully fledged.

I once found Pileateds nesting within forty yards of the nest of that powerful predator, the Great Horned Owl. The woodpecker nest hole was fifty-five feet high in a living White Oak. This alone incites admiration for the strength and carpentry of the Pileated. The nest hollow had been drilled directly below a dead branch, an area offering a somewhat softer point of entry to the heart of the trunk. The wood was very hard and tough. Some of the chips lying on the ground below measured nearly three inches in length and would have done credit to a man with hammer and chisel. An adult female, which was brought in to me, managed to completely ruin a small metal-lined holding cage in one night. The second night I liberated her in a large aviary and arrived

the next morning to find two four-by-four-inch supports nearly severed. The construction foreman's weak smile and my mind's eye picture of a demolished plaster-walled cage helped me reach a decision to release my powerful housewrecker. A nest cavity usually has an entrance measuring about three-and-a-half to four inches in diameter and is broader at the bottom than the top. The cavity itself is generally about two feet deep, but may vary considerably. The lower half of the cavity may be as much as six or seven inches wide but the nests I have examined all seemed very crowded when the young were well grown. The Pileated's beak is very hard and the point is laterally compressed, forming a surface like that of a wedge resting on its side. Woodpeckers have one advantage over human carpenters in having their eyes close enough to their work to do a really accurate job. Carpenters who begrudge

This bottomland forest near the Merrimac River in Missouri is ideal homeland for the Pileated Woodpecker and it was here that the author was fortunate enough to find a nest and eggs.

Photographs by the author.





A Pileated is clinging to the loose bark of a dead tree just at the edge of its nest cavity. Pairs often return to the same tree year after year, but rarely make use of the same hole.

them this slight edge, however, might try driving their chisels with their heads! I have found Pileated feeding holes measuring more than half a foot deep, leading to ant chambers, in fairly hard trees. One particularly amazing assault, on a tree infested with ants, measured nearly four inches wide, twenty-two inches long, and, in places, seven inches deep. Pileated diggings are characteristically rectangular with the long axis parallel to the tree trunk. Their size and shape usually permit easy identification.

Fall and winter make insects hard to obtain and, as might be expected, Pileateds turn more to vegetable food during these seasons. Acorns, beechnuts, various seeds and berries have been recorded in the Pileated menu. Ants, however, are the favorite food. As many as 2,600 ants have been recorded from a single Pileated's stomach. Like the Flicker, the Pileated occasionally descends to the ground to feed, but most amazing is

its ability to recognize ant trees and to drill accurately to the chambers of the ants. Leaning against a three-foot stump one day, I had spent several pleasant hours observing Pileated nest-hole activities when I discovered, to my discomfort, that there was a large colony of black ants somewhere near. By this time, the Pileateds had become accustomed to my presence and were not too restless if I sat quietly while watching them; even though not hidden from view in a blind. The appearance of ants at my observation post made another point look more attractive and I moved. Within an hour, the male Pileated had located the ant colony in my former backrest, and chopped into it. It is difficult to say how the center of a colony of ants or the home of a beetle larvae is located. Possibly, in addition to some odor and visual clues, the Pileated hears movements of the colony or even judges the position by assessing the sound its tapping makes over wood of different densities.

An area in which some calamity has caused a die-off of large trees will present marvelous feeding territory. The midwest drought of the past few years produced nearly optimum conditions for Pileateds in some forest tracts. An area of approximately two square miles of river bottom-land where I had found one Pileated nest in 1950, had four in 1956. The Flicker, Red-bellied and Red-headed Woodpecker population had also greatly increased. Of course, this situation will not endure for long. Very shortly the standing dead trees will fall and rot to stages no longer favorable to the Pileated's food insects. When less food becomes available, we may expect the Pileated population to dwindle and when food is scarce it would be surprising if so many nesting pairs would tolerate each other in the small area I watched. Broader territories are likely to be more strenuously defended when it is more difficult to find food for young. It was amazing to find two nests, in 1956, within one hundred yards.

Pileateds rarely use a nest cavity more than once. Even when re-nesting in the same season, after some catastrophe has caused the loss of their first clutch of eggs, an entirely new nest is frequently drilled. Pairs will often return to the same tree several seasons in succession, drilling a new nest each season. One fallen tree I examined contained three old nest hollows.

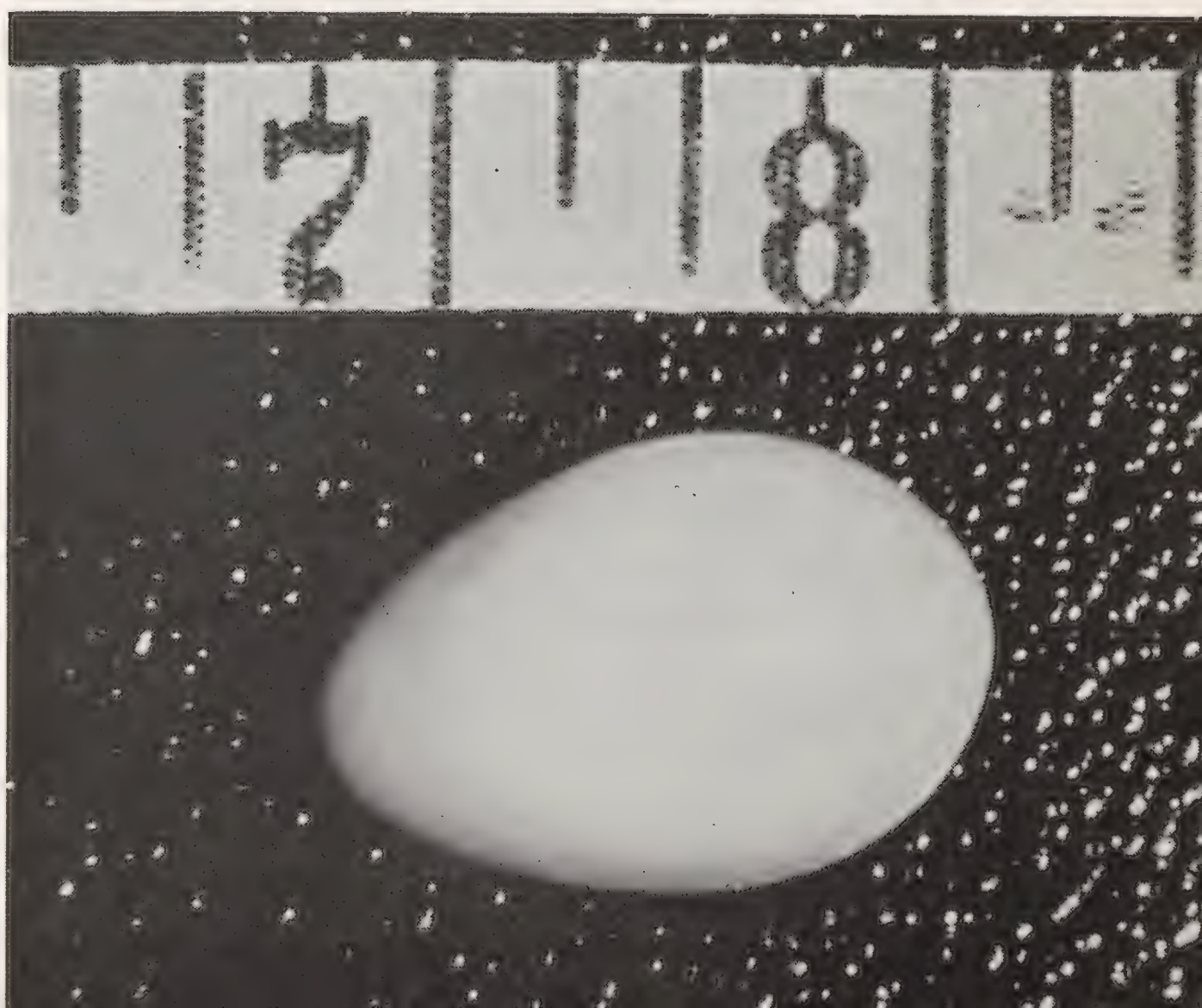
Attempting to locate Pileateds in woods where their characteristic diggings have been found, I have used a large variety of ruses — and found most unsuccessful. Despite their size and brilliance, Pileateds are usually difficult to see even in areas where they are not uncommon. When the birds are nesting, they can be amazingly silent; they fly just under the forest canopy with such an abrupt swinging flight that trailing them is out of the question. On the few occasions when I have been able to call up a Pileated during the nesting season, imitating its drumming by tapping logs with a piece of wood or mimicking its call — kuk-kuk-kuking my lungs out — the birds have come in a cautious fashion and left in some direction other than nestward. When it is

available, the birds seem to prefer a dead, almost branchless, stub for nesting. It should be tall, though some nests as low as twelve feet have been reported. Missouri bottomland nests with which I am familiar were most commonly found from forty to sixty feet up. Therefore a nest hunt in Pileated country consists of carefully choosing likely-looking nest site trees, under the forest canopy, and examining the trunks for nest holes and their bases for fresh wood chips. Using this method, I located four nests in one day in the spring of 1956, an exceptionally lucky day in a good year for Pileateds in the midwest. Abandoned nest holes are a boon to many home-hunting creatures. White-footed mice, owls, flying squirrels and wood ducks are just a few of the



*pair (the male at the left) of
Pileated nestlings about 16 days
old. They are ready to leave the
nest at the age of 22 to 26 days.*

*The egg of a Pileated Wood-
pecker is surprisingly small —
about an inch and a half long.
It is white, glossy and pointed.*



forms which have been found in old Pileated tree cavities.

Each nesting I have examined has, thus far, produced three eggs, although records of four-egg clutches are apparently more common in some areas. Unfortunately, finding six nests in 1956 did not mean that the pleasure of seeing six successful Pileated broods was to be mine. At least three of my '56 nests were abandoned for various reasons. In one case, human vandalism seemed the cause. Another, a nest I was particularly interested in because of its photographic potentials, was suddenly abandoned, without apparent cause. When I climbed the tree to investigate, I found that squirrels had appropriated the hollow. It is impossible to say whether the squirrels had forced the Pileated out or whether the Pileateds had abandoned it for some other reason and the squirrels had taken over. In any event, the most photographable, climbable and observable nest I have ever found was lost just as egg laying should have commenced. Needless to say, the very factors which made the nest accessible for an ornithologist may well have led to its failure.

If some calamity causes the Pileated to abandon its nest early enough in the nesting cycle — that is, before incubation is too far along — there is some evidence that the birds will re-nest, digging an entirely new cavity. To complete a nest, Pileateds may devote anywhere from two to six weeks of hard labor. Many factors, in addition to the hardness of the wood chosen, are involved, and disturbances which would go practically unnoticed when the nest is further along may cause abandonment or prolong the labor in early nest digging stages.

I have never been fortunate enough to see the complete courtship display of the Pileated. One instance, worth noting as a small part of the courtship, perhaps, occurred last spring after a short rain in my favorite stretch of Merrimac forest. Tramping down a flat place in the wet undergrowth, I had taken a post near a tree containing a Pileated nest some sixty feet up. The male, frightened away by my arrival, soon returned to the cavity, an order of return which seems usual throughout the cycle. Even when the female was flushed off the nest, most frequently the males returned first to assess the situation. (Male

and female share the duties of incubation.) The nest was completed, or nearly so, and egg laying should soon commence. The male, deciding apparently that I was the same old harmless mosquito bait he had seen before, flew to a distant sycamore where the gentle breeze waved the large ragged leaves to and fro, causing a gentle dripping of fresh rain drops. There, after a few settling branch taps, the Pileated spread its wings, fluffed, shook its plumage, and bathed while silhouetted against the clearing sky. My thirty-five-power telescope has never brought me a more rewarding sight than the close-up view of this magnificent forest dweller, with flaming crest erect, wings spread, shaking his plumage in the showery April sunshine. Finally, retiring to a high, dead branch, the Pileated began his long, rolling drum. The limb he had chosen appeared hard and gray and subsequent observation showed it to be a favored post. Holding himself very tightly with body well out from his musical instrument, the Pileated made a few brief, precise bill-wiping motions, like a drummer polishing his sticks, then abruptly struck the limb with an increasing number of sharp blows which rose, descended and faded. When the drumming has stopped the listener has the feeling, because of diminishing echoes, that the strangely musical sound gradually dies away. Few sounds are so capable of making a forest seem so large and an ornithologist so small. After nearly an hour at the drumming post, when some seventeen performances had been completed, the male abruptly disappeared. Half an hour later my attention was drawn from the fascinating hunting activities of a Broad-headed Skink, which had been examining each nook and cranny of the forest floor only six feet from me, by a slight sound at the nest tree. I looked up to see the female Pileated join the male several feet above the nest hole. Abruptly stiffening, spreading his wings and erecting his crest, the male bowed his head twice, as though to strike the tree, but stopped just short of the bark. The female spread her wings stiffly in response and both birds jerkily circled the trunk. One, I could not tell which, made soft clucking sounds almost like those of a male Quetzal. As suddenly as the pair had arrived, they flew off, leaving the significance of their performance in doubt as far as I was concerned.

A nest full of young Pileateds sounds like nothing so much as a beehive out of tune or a television set with a defective oscillator. Only great faith in the descriptions I had read gave me the courage necessary to thrust my ungloved hand down into the maws of my first brood of young Pileateds. Anything more ugly and helpless-looking than the unfeathered young of this species is hard to imagine. Pink-skinned, with thick blue lines of future feather tracts, with long thin neck, huge head, enormous bill, closed eyes, pitiful wings covered by a porcupine-like growth of developing feathers, and big feet, all built around an enormous paunch-like belly. This is the Pileated Woodpecker at seven days of age.

When the young are small, the female spends long periods in the nest, probably brooding the family. Males are said to frequently roost in the nest at night. As the nestlings grow larger, both parents spend less time at home. The female seems to make the greatest number of feeding visits which rarely exceed one every thirty minutes from early morning to early evening, after the young are ten days old. When the nestlings are about fifteen days old and their feathers still largely sheathed but well sprouted, the observer is in for an amazing surprise. Well I remember getting my movie camera in position near a Pileated family, focusing the telephoto lens on the nest entrance, when an awkward, red-topped, semi-nude head pulled into view. From the depths of the twenty-four inch cavity the young Pileated had managed to hitch, pull and brace himself up to the nest opening for perhaps his first look at the outside world. Using his wrist joint with almost as much facility as a young Hoatzin of the Amazon, or some ancestral reptile of past ages, Carrot-top braced himself in the nest entrance and looked about him with an air of one who knows what he wants — food! He — it was a male and could be distinguished already by its red chin patch — was not disappointed and the female arrived, landing a few feet above the nest entrance. The young male immediately set up its rasping, buzzing clamor, joined by his less venturesome nestmates below. Previously, I had been able to see the tip of the feeding parent's tail rapidly jiggling up and down in the nest entrance as the feeding operation took place in the bottom

of the nest cavity. As the young had grown, the parent's tail protruded further and further from the nest, giving a visual record of the nestlings' growth as it became less necessary to climb down into the nest to reach their outstretched heads. Now, mother hitched down beside the entrance to the nest hollow, leaned sideways, placed her bill in the venturesome little male's waving gape, and began a rapid stabbing-like regurgitation of food. Probably most of the stabbing motion may be attributed to the nestling. Nestlings which I removed from their home for photographs, readily grasped an offered finger and attempted to swallow it with this rapid staccato jerking motion. In any event, although the parent is the assaulted party, the close-up impression is one of deliberate throttling infanticide rather than a normal feeding routine. An unpleasant but accurate picture is that of an animated stomach pump in reverse. My venturesome fledgling had scarcely gotten his fill, when up from behind him appeared another awkward, swaying head and gape to be filled in turn. Apparently unable to bear the noises of brotherly satisfaction, little sister had appeared to claim her share in this successful, adventurous new method of feeding. Hereafter, the young spent a good part of each day with heads waving from the nest entrance like tentacles from an anemone, looking for food. Imitating the adults' call, I tried to elicit gaping from the young birds, but failed. The chicks' gaping response had matured to respond at the sight of their parents. No longer was it possible to induce the young to attempt to swallow a finger. Four-day-old chicks will respond to a passing shadow or a darkening of their nest hole even though their eyes are not open. Under the forest canopy, my young birds had little opportunity to see hawks circling above, but a turkey vulture which lighted some sixty yards away, which they could have seen, caused no discernible response. On several occasions they appeared at the nest entrance shortly before a parent brought food, when I had heard no unusual or very near calls from the old birds. Whether this was coincidence or whether there was significance in certain calls which I missed, is the kind of question which cannot help but fascinate one interested in animal behavior. Usually, nidification is complete in twenty-two to

twenty-six days and the young leave the nest still under the close supervision and care of their parents.

Normally, these huge forest dwellers are resident wherever they are found. While some population movements do occur, in winter, no large-scale migrations have been recognized. Some evidence indicates that Pileateds mate for life; certainly pairs may be found in constant association

through the winter months, even roosting in the same hollow together.

The Pileated population does not seem to be declining, in fact, increases are being noted in several areas. Thus, while we have probably lost, forever, the wonder of the vanished Ivorybill, with care and thoughtful conservation we may enjoy and preserve the wild call and stirring sight of the great Stump Breaker.

The Last Stronghold of the Mountain Gorilla in East Africa

By OLIVER MILTON

Former Game Ranger in Tanganyika, East Africa

ON FEBRUARY 25, 1956, John Blower, a Game Ranger in Uganda, and I left the small custom post of Kisoro, on the Uganda-Belgian Congo border, for a day's trip to the saddle between Muhavura and Mgahinga Mountains to look for Mountain Gorillas and photograph them if possible.

In East Africa the Mountain Gorilla is found only in the Kigezi district of southwest Uganda. They are known to inhabit the Kayonza Forest and the slopes of the three extinct volcanoes — Muhavura, Mgahinga and Sabinio — of the Mafumbiro range on the border of Uganda, Ruanda Urundi and the Belgian Congo. The habitat has been decreed a sanctuary but although the slopes of the three old volcanoes cover about twenty square miles, the gorillas are confined to a very much smaller area. The reasons for this concentration became apparent as we climbed.

We left camp at 7 o'clock in the morning and drove for six miles to an old hut built by an engineer, Schrandl, while he was constructing a furrow from the swampy saddle between Muhavura and Mgahinga to help irrigate the thickly populated area lying at the northern foot of the range of mountains. On the way we collected a guide, Reuben Rwenzagire, who had lived there

for many years and was familiar with the whereabouts of the gorillas. We also recruited three members of the semi-pygmy Batwa tribe to carry some of our equipment.

For the first three-quarters of an hour after leaving the deserted Schrandl camp we climbed through very steep cultivated areas. Between the plots of potatoes and wheat the flowers of *Hypericum*, *Kniphofia* and *Helichrysum* added color to the environment. At a resting point we had a wonderful view over the lower mist-covered hills surrounding Lake Mutanda, while above us the clouds hid the mountain peaks from view. The cultivated areas soon ended and for the next half hour we struggled through a very thick belt of bamboo. None of the stems exceeded two and a half inches in diameter and most of them were about an inch thick. Just before we stopped for another rest we disturbed three buffaloes which crashed off into the murky forest. While we rested one of the porters wandered off but returned quickly when a large buffalo walked out of the bamboo directly in front of him.

We reached a trace cut by the Forest Department to mark the boundary of the Reserve. It was a path about fifteen feet wide and after following it for some way we again plunged into some



very dense forest that consisted of tall trees covered with *Usnea* and damp, thick undergrowth. The bamboo had now almost disappeared. According to our guide, the Forest Reserve boundary was moved half a mile up the slope during the last two or three years, up to which time gorillas had inhabited the areas that were now either under cultivation or being prepared for such a purpose. The cultivated slopes up which we had walked were, in fact, known as "Rwengaji" or "Place of Gorillas." Human encroachment had driven them further and further up the mountain and with them went the Yellow-backed Duiker and the buffalo. At several points in the forest we saw where the villagers had cut the bamboo, leaving an open space or a lot of secondary growth, unpalatable to gorillas. If the bamboo is eliminated to any further extent the gorillas will move over the saddle into the territory of Ruanda Urundi. Once here they would be safe from threatening cultivation but the region would be robbed of the Mountain Gorilla forever.

As the slope leveled off near the saddle we

Mountain Gorillas live in the thick forests on the slopes of these extinct volcanic cones in East Africa — Muhavura on the left, Mgahinga at the right. Cultivation is driving gorillas out.

Photographs by the author.

came to several large swampy glades which were for the most part surrounded by tall bushes of *Hypericum* and various large-leaved *Compositae*. The mist cleared for short intervals, enabling us to see the summits of Muhavura and Mgahinga towering above us. Except for the squelch of our boots there were few other sounds — it was a silent and misty world.

Our first intimation of the immediate presence of gorillas was a small pile of recently-chewn bamboo and some fresh droppings. At these signs the porters paled and gave one the idea that they would prefer to return home. The guide felt confident that we would see a gorilla fairly soon but as the mist had descended once again, I gave up any hope of photography, especially as at times we were walking and crawling through very thick undergrowth. Our hopes rose again when we came to a fresh nest-like bed in the



This Mountain Gorilla's bed has been made in a thicket. It was about four feet in diameter and was composed of stems and leaves.

midst of eight-foot-tall vegetation. The bed was about four feet in diameter and was made of stems half an inch thick that had been broken from the nearby bushes. Many leaves had been added, presumably for additional comfort. Some of the bushes in the immediate vicinity had been bent over to form part of the bed. The central depression, about ten inches deep and two feet in diameter, was filled with droppings that had been flattened by the animal's weight. On account of the dew and rain it was not possible to determine the age of the bed but it was certainly very fresh.

After we took photographs our small party continued through almost impenetrable bushes. It was still misty and we tried to make as little noise as possible. Suddenly there was the most horrifying scream and seven yards ahead of us a gorilla shook the bushes and ran to some thick undergrowth on our left. We caught only a glimpse of the animal but were able to watch leaves and branches move as he (or she?) backed slowly away from us, pausing every now and then, presumably to peer back. We found it had been resting on a bed similar to the one we had just found. This bed, however, was spotlessly clean. We waited for ten minutes, hoping to see the same or perhaps another gorilla, but none appeared and so we pushed on to the open and

swampy part of the saddle. We arrived in time to see the mountains of Ruanda before the mist rolled over us. Visibility was reduced to a few yards and so we decided to return to camp. Growing on the saddle were many Lobelia, Artemisia and ground orchids. As we started the downward journey we passed a signboard demarcating the boundary of the Parc National Albert. Further down the path we saw more signs of gorilla — droppings and broken stalks and leaves — but once we reached the cultivated areas, all wildlife was left behind us.

IN 1951-52 there was no human habitation above Schrandl's camp and gorillas came down to this point. Now the cultivated area extends half a mile above the camp and bamboo cutting still further. If the Forest Department continues to decrease the area of the Reserve, the gorillas will go. The cutting of bamboo should be stopped, at any rate in the areas known to be inhabited by gorillas; bamboo is used for building and making fish traps but could easily be obtained elsewhere in the vicinity.

In 1927 Carl Akeley estimated there were a hundred gorillas in this area. Now the estimate is fifty. This is based on figures from the Game Department and the local inhabitants.

The whole area should be a National Park, contiguous with the Parc National Albert. Failing this, *no one* should be allowed to enter the area without special permission, as is done in the Congo. Anxious to obtain photographs, visitors have been known to organize gorilla drives with a result that numbers of the animals moved across the border. I feel sure that this interference by human beings must have an adverse effect on their breeding.

Natives who live at the foot of the mountain should not be allowed to take their cattle into

the Forest Reserve. Not only do they damage the flora but if any gorillas are seen, the cowherds stone them.

Although the European knows that these are the last Mountain Gorillas in East Africa, the African regards it as a matter of small importance. "If they are safe in the Congo, let them go there and let us cultivate up the mountain slopes," he says. With the African playing a paramount part in ruling Uganda, I am certain that unless steps are taken at once, the Mountain Gorilla will be extinct in East Africa.

News from the Conservation Foundation

Eastern Water Law Study

Finished manuscripts of a study of the water laws of the Eastern States have been turned over to the Ronald Press for publication. This book will include a series of papers prepared in connection with the Water Law Symposium held in Washington in October, together with an edited transcript of the symposium proceedings. It is hoped that publication will be possible during the early summer.

Marine Resources

The study of Marine Resources by Dr. Lionel C. Walford has been turned over to the Ronald Press and it is expected that the book will appear in the early fall.

Land Use Studies

Preliminary investigations are being instigated over a wide area of problems connected with land use. These are essentially staff reconnaissance studies to help in establishing a long-range research program in land use similar to the long-range water problems series and the various population studies. Peter Stern and Stephen Bergen, Assistant Directors of Research, will be immediately responsible for these studies. Mr. Bergen is on an extended trip to the West Coast in connection with this program and is participating in several professional meetings.

Curriculum Analysis

In the last issue of *ANIMAL KINGDOM* it was mentioned that curriculums related to conservation in the elementary and secondary school systems were being collected and analyzed. This work is being carried out by Elizabeth Hone.

So far curriculums received represent major cities which together enroll approximately one-sixth of the total school population of the United States. In addition we have received curriculums from state education and/or conservation departments, secondary school districts, teacher training institutions and some smaller cities. A preliminary analysis reveals that several times more emphasis is given to renewable resources than to nonrenewable resources.

Occasional visitors tell us that our curriculum collection even now is unique in the United States. It is beginning to serve both as a valuable reference collection for those who live in the area and as a means of answering the questions of correspondents in all parts of the country.

A New Type of Film Strip

The Audio-Visual Department is developing a new type of film strip in association with IMPCO Associates. This is aimed at working out a pilot program of one film strip to determine the value of the projected program.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

THE AQUARIUM IS AT LAST ON THE OCEAN FRONT

FOR THE INFORMATION of future historians of the New York Aquarium, the "interim" Aquarium in the Lion House at the Bronx Zoo actually ceased to exist a little after noon on Wednesday, March 13. At that time the last living creatures were loaded into a truck and rolled away toward Stage One of the new Aquarium on the ocean front at Coney Island.

"Interim" though it was, it lasted a long time. The old Aquarium at Battery Park officially closed its doors on Wednesday, October 1, 1941, and some of the temperate and tropical freshwater fishes came to the Zoological Park and went on exhibition on Thursday morning, February 12, 1942. Fifteen years and fifteen days later, on the night of February 27, 1957, the Lion House collections of aquatic exhibits had been dispersed to such a point that for the first time it was not necessary to keep a night tankman on duty. The only living things left were 125 Electric Eels stored in the Lion House basement as part of a continuing research project, 1 Lungfish and 1 Loggerhead Turtle.

They, too, were trucked away on March 13 and now all our Aquarium eggs are in one basket — the handsome new basket beside the sea at Coney Island.

As ANIMAL KINGDOM goes to press, it appears that the dedication and official opening of Stage One of the Aquarium will be held on Thursday, June 6. Every Member of the Zoological Society will receive adequate — and even elaborate — notification of the details of that long-awaited affair. As well as, of course, an invitation to attend the ceremonies.

There have been few events in the Society's recent history that have aroused so much interest as the forthcoming reopening of the Aquarium.

Typical is the following editorial from the *New York Times* of February 1:

THE COMING AQUARIUM

At the sixty-first annual meeting of the New York Zoological Society Dr. Fairfield Osborn, the president, announced May 15 [now changed to June 6] as the date of an event long awaited by New Yorkers. The new Aquarium on the ocean front at Coney Island will then open its doors, the \$1,500,000 first section of what is finally expected to cost perhaps \$10,000,000.

Situated on twelve acres of land, and with a parking lot initially able to handle more than four hundred cars, the new Aquarium is of bluish gray brick construction, two stories high, with a basement level containing laboratories, offices and service equipment. A restaurant on the upper floor will look out over the ocean and into a large outdoor tank of aquatic specimens which is one of the interesting features.

Marine life from all over the world will be exhibited, and specimens are already arriving by way of Florida, California and elsewhere. Walruses, sharks, turtles, hundreds of specimens of fishes will be on display, with the first stock of exhibits estimated to cost about \$200,000. New York has not had an Aquarium since the old building at the Battery closed fifteen years ago.

Dr. Osborn stresses the teaching aspects of the society's work, its scientific interests, its concern with wildlife preservation. He notes that as civilization crowds in upon us in a machine age the society fulfills an ever more important mission in presenting the opportunity to young and old to enjoy close at hand the living things of nature.

We might add that this costs money. The Aquarium, for instance, in which the city government matches the society's capital expenditures, will not grow to full planned size unless the public pitches in with gifts of \$4,000,000 or \$5,000,000 more. The hundreds of thousands who have enjoyed the Zoo in Bronx Park and the old Aquarium of other days have their opportunity now to show their appreciation in building for their own future pleasure and for a new generation.

All members of the staff of the Aquarium are now "in residence" at Coney Island. The official postal address is Boardwalk at West 8th Street, Coney Island, Brooklyn 24, N. Y., and the telephone number is Coney Island 6-8500.

IN BRIEF

Castor's New Home. Since their own birth here in 1944, Dacca and Rajpur, our Tiger parents, have produced young every year except one, starting in 1948. Their offspring now total 27, of which 23 have been sent to zoological parks from California to Maryland, north to Wisconsin and south to Texas, to the Taronga Park Zoo in Sydney and to Brussels. The latest to leave us for a new home was Castor, a magnificent male born on June 3, 1956. From a birth weight of 3 pounds 9 ounces, Castor had grown to 123 pounds when he was bought by the new zoological park in Birmingham, Alabama. Both the Mayor of Birmingham and the director of the zoo telephoned after Castor's arrival to express their pleasure in his size and good condition.

Teaching the Teachers. Twice a year, in fall and spring, the staff of the Zoological Park and the Aquarium gives a 15-week course on "Utilization of the Bronx Zoo in the Science Program of the Elementary and Secondary Schools" for teachers in these schools. The fifteenth such course has just started, with an enrollment of about 40 teachers. Presumably this familiarization of the teachers with the facilities of the Zoological Park makes a real difference in their interest, for visits to the Zoo by school classes are increasing each year.

No Substitutes Accepted. When a pair of Humboldt Penguins began incubating two eggs in the Penguin House late in January we were hopeful that — for the first time since the building was opened in 1950 — the indoor colony would be able to carry breeding to the hatching stage. The Humboldt eggs were ten days along when the Emperor Penguins began taking an interest in them, and one egg was smashed. To distract the Emperors, the Bird Department provided a rubber ball and one of the big birds settled on it and seemed quite content until it slipped out from under and bounced away in a very un-egglike manner. The Emperor waddled after it and examined it in a nearsighted, distrustful fashion, but seemed willing to try once more. Again the ball bounced away as the bird

attempted to settle on it, and this time the Emperor disdained to try again. The next day, as we were preparing a barrier to prevent another raid on the remaining Humboldt egg, the Emperors managed to knock the egg out and it was broken.

Not Earlier This Year. In the last issue of *ANIMAL KINGDOM* we pointed out that our big American Elk was dropping his antlers on successively early dates — April 18 in 1947 and March 17 in 1956. We rather expected it would be even earlier than March 17 this year, but instead it was later — March 19. Both antlers went off at the same time. They weighed 23.1 pounds.

PUBLICATIONS OF INTEREST

SNAKES AND SNAKE HUNTING. By Carl Kauffeld. 266 pp., 14 black-and-white photos. Hanover House, Garden City, New York, 1957. \$3.95.

The Staten Island Zoo has one of the outstanding snake collections of this country. Its exhibition of rattlesnakes is excelled only by the great collection of these snakes at the San Diego Zoo. The credit for the quality and quantity of Staten Island's reptile exhibits goes primarily to its experienced Curator of Reptiles, Carl Kauffeld. In fact, Kauffeld personally collected most of its snakes that are native to the United States. In "Snakes and Snake Hunting" he relates the experiences he had while collecting them.

In his book he gives the reader the vicarious thrill of one of man's most exciting activities — catching snakes alive. The reader can share the frustrations and joys of long, tiring, but exciting tramps through the palmetto-pine flatwoods of Florida, the Spanish Moss-festooned swamps of the Carolinas or the rocky remoteness of the Huachuca Mountains of Arizona.

While the book is essentially an account of Kauffeld's experiences with snakes in the field, it contains observations on the habits and habitats in which the various species are found. The book closes with a commendable "Plea for Snake Conservation" in which the author proposes the organization of a group similar to the Audubon Society but devoted to "bringing about an attitude generally favorable to reptile conservation."

There are a few statements in the book that I find it difficult to agree with. For example, to say that the "world's first four largest and most deadly snakes" include the Bushmaster, the Fer-de-Lance and the Diamondback Rattlesnake seems to be an unwarranted disregard for some larger and deadlier snakes of the Old World, i.e., Black Mamba and Taipan — we both agree on the King Cobra. However, such reservations are few and the book is written in a pleasantly readable, almost conversational, style. It is recommended for all who are interested in entertaining firsthand narrative accounts of outdoor activity, and especially to amateur herpetologists. — J. A. O.

EELS. A BIOLOGICAL STUDY. By Léon Bertin. viii + 192 pp. Illus. with 64 plates and text-figures. Cleaver-Hume Press, Ltd., London, 1956. British Book Centre, New York, N. Y. \$5.50.

Books of genuine interest and usefulness to both the specialist and the general reader are not common, but this is one. It offers the most comprehensive account of the life history of the European Eel, from its birth in the depths of the Sargasso Sea to its return there for reproduction and death. Comprehensiveness alone is not enough to recommend a book to laymen, but Prof. Bertin has managed to put his account in non-technical language that makes clear the techniques of scientific investigations as well as their results. — J. W. A.

AUDUBON WESTERN BIRD GUIDE. Land, Water, and Game Birds, by Richard H. Pough. Colored illustrations by Don Eckelberg. Sponsored by National Audubon Society. Doubleday & Co., N. Y., 1957. \$4.95.

Third and last of the Audubon Bird Guide series on North American birds, this book completes the work begun by Mr. Pough in 1946. Much interesting and stimulating information is well presented for the bird student.

This volume is not an independent guide to western birds as the title would imply, but the completion of a

series. Unfortunately, the Western Guide has fallen heir to the complications and loose-end tying usual to final volumes. Six hundred and fourteen species are mentioned, but only ranges are given for 411 of these forms. The reader is referred to the previous Eastern Land and Waterbird Guides for plates and discussion of such species. Though geographically titled, the three volumes overlap rather haphazardly. The Western Guide is comprehensively indexed for the previous works, which, needless to say, are not cross-indexed.

The nomenclature of the Western Guide has been brought up to date. Several unfortunate typographical errors in common and Latin names have occurred and a bad mixup has developed in the swan classification. Trumpeter and Whistler swans are assigned the genus *Cygnus* in the text, and a genus *Olor* (?) in the Index and Contents.

Careful color illustrations by Eckelberg and black and whites by Shortt greatly increase the value of the book.

This book should not be mistaken for a handy field guide, but the completion of an interdependent valuable reference series which will be of interest to all ornithologists, amateur or professional. — W. G. CONWAY.

New Members of the New York Zoological Society

(Between January 1 and February 28, 1957)

Benefactor

Landon K. Thorne

Patron

Mrs. E. Gerry Chadwick
John Elliott
Miss Irene Hayes

Life

Lt. Col. Pierre Offermann
Miss Siri Jennings Vail

Contributing

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George Payne Bent, II
Mrs. F. Henry Berlin, Jr.
Charles Burlingham
Mme. Alma Clayburgh
Frederic H. Cruger
Mrs. Edward P. Curtis
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Charles M. Stern, Jr.
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Hobart G. Weekes

Three Saturday Morning Members' Tours This Spring

MEMBERS' TOURS on Saturday mornings are delightful occasions. The Zoo is at its very best in the Spring and the very best way to appreciate it is to take a leisurely ramble through it on foot and by tractor train under the expert guidance of a Curator. He always knows what's going on and he'll make sure you see everything of particular interest. He'll know, for example, that the fawn born yesterday is hidden by the big maple near the brook, that the Rose-breasted Grosbeak is singing in the Bird House, that the Indian Python is shedding its skin—instances of rare enjoyment that you might miss without his help.

The tours start at 11 A.M. from the Members' Room in the Administration Building and end about 12:30. Members are encouraged to bring children and guests (but please, not *too* many). If you come by automobile, drive in Rainey Gate off Pelham Parkway anytime until 11 o'clock and you'll find a parking space reserved for you. It's not necessary to notify anyone that you're coming—you are expected and will be very welcome.

SATURDAY, APRIL 13: BIG MAMMALS AND CHILDREN'S ZOO

Curator of Publications William Bridges, who likes Elephants so much that Members will probably have to drag him past their enclosure by force, will lead the first tour. He plans to show a short movie about elephant training, a tractor train trip to see the deer, a visit to the Small Mammals, a peek at the Children's Zoo (which opens that day), and, of course, a good look at his favorites.

SATURDAY, MAY 11: PENGUINS—ANTELOPES—APES

Membership Secretary Gordon Cuyler will lead this one—and it's a sure bet that Penguins will figure largely in his plans. There will be a short movie about these wonderful birds, a visit to the Lion House to see the Martinis and their big cats, a tractor train tour through African Plains, a stop-off to feed grapes to the Apes and then, of course, the Penguin House.

SATURDAY, JUNE 15: REPTILES AND BIRDS

Curator of Reptiles James Oliver has promised to refrain from taking Members directly to the Reptile House. He'll screen a brief movie about the defenses of snakes, and on the way to the Reptile House will lead the group through the Bird House (to point out some of the affinities between birds and reptiles) and visit the outlying wildfowl ranges via tractor train.

Other events of interest to Members this Spring are:

Saturday, April 20—Pelicans will be released on Cope Lake about 11 o'clock (weather permitting).

Monday, April 22—Look for the five color pages about the Zoo in *Life* Magazine.

Saturday, June 1—The family of White-handed Gibbons will move into their summer home on their island in the Bronx River about 11 o'clock (weather permitting).

Thursday, June 6—Members' Day to open Stage One of the new Aquarium on the Ocean Front at Coney Island. (You'll get further notices about this gala opening).



ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LX JUNE No. 3
 1957

The New Aquarium

THERE HAS BEEN A VOID in the life of this great city and it is being filled now. Years of planning lie behind, years of growth lie ahead — but, with the opening of this first unit of the incomparable institution-to-be, we are really on our way.

How can one define the significance of an institution such as this? A ready answer is that of all the wonders on this earth none is so mysterious as the life within the oceans and under the dark surfaces of rivers and lakes. Yet this is only part of the answer, for the more evident truth is that most of us Americans have become city-dwellers and yet we have a continuing and innate craving to observe and enjoy the living things of Nature. So it is that each year more than 60 million people go to the well-established zoos, now to be found in most of our larger cities. However, good public aquariums that really do justice to the wonders of marine life are a rarity in the United States, only a handful being worthy of the name. This fact makes the new Aquarium in our country's largest city all the more desirable. It also emphasizes the need for its ultimate completion.

Plans for the final Aquarium represent an institution of such beauty, interest and educational value that it will stand unchallenged as the most notable center of public interest of its kind in this country or, indeed, in the world. We must hope that the First Stage, opened for public enjoyment on June 6th, will prove the steppingstone towards the realization of a completed institution worthy of New York.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

JUN 11 1957



THE AQUARIUM WILL BE BORN AGAIN ON JUNE 5

By WILLIAM BRIDGES

AT THIS LATE DATE in New York City's history it is rare for a new institution to come into being. The pattern of the city's cultural interests was rounded out long ago and there will not be many opportunities for future generations to boast of remembering the day when a major Museum, or Botanical Garden, or Zoological Park, or Aquarium was dedicated and opened to the public.

The dedication of Stage One of the new Aquarium at Coney Island on June 5 is, conse-

quently, a historic event. It is true that it is a rebirth rather than a "first beginning," but the Aquarium that is about to reopen bears very little resemblance to itself in its previous homes — the old converted fortress at the Battery and the Lion House in the Bronx Zoo where it has existed as an interim exhibition for the past 15 years.

The New York Aquarium as a legal and physical entity dates from December 10, 1896, when the City through the Department of Public Parks (as the Department of Parks was then called)



formally opened the doors of the old Castle Garden and invited the citizens to come in and look at a collection of fishes. On October 31, 1902, the City transferred the management of the institution to the young New York Zoological Society that was making such a success with the new Zoo up in the Bronx wilderness. In this ever-changing city it is interesting to note that Prof. Henry Fairfield Osborn, as President of the Zoological Society, made the acceptance speech for the Society. On June 5 Fairfield Osborn, his son and today's President of the Society, will preside at the dedication of the new building.

The old Aquarium at the Battery became one of the great Aquariums of the world but it was always uphill work to make and maintain its collections; a circular ex-fortress with walls of red sandstone eight feet thick imposed limitations that could not be overcome. Among the operating personnel, therefore, there was not too much regret when the old Aquarium was closed on October 1, 1941, with the promise of a shining new

Brightly colored fishes of the coral reefs are the "specialty" of the new Aquarium on the ocean front at Coney Island. This is one of the tanks that simulate a reef and its varied life.

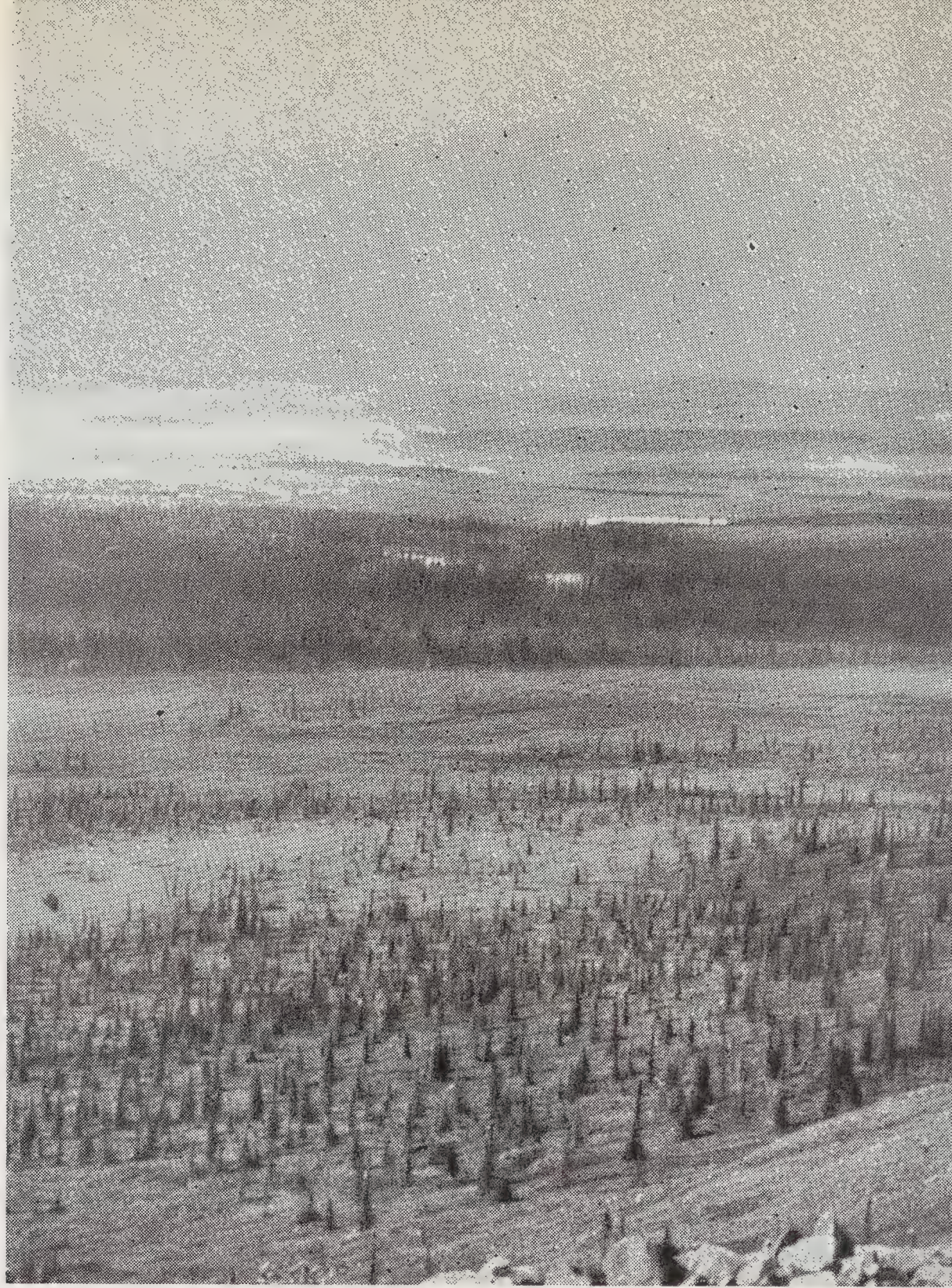
home designed for the specific purpose of exhibiting fishes and invertebrates and aquatic mammals and birds. A new home there *had* to be if the Aquarium were to grow with the times.

Part of the temperate and tropical freshwater collections were moved into tanks set along the west wall of the Lion House in the Zoological Park; the staff moved into its temporary home and began planning the Aquarium of its dreams. That it has taken so long to turn those dreams into reality is regrettable, but there have been many good reasons for the delay. The complete, enormous, \$10,000,000 Aquarium as planned is still to come, but Stage One is finished; the beginning has been made. Essentially it is a new institution and June 5, 1957, is a historic day.

THE GRIZZLY BEAR

&

THE WILDERNESS



WE GUESSED we would have much to do with Grizzly Bears that summer. On the day the bush plane landed the second contingent of our party at Lobo Lake, at the entrance to the Brooks Range of Alaska, we saw two bears out on the tundra. And in the weeks that followed, when the five of us were exploring up the Sheenjek River to study the ecologic and wilderness values of the east end of the Brooks Range on behalf of the New York Zoological Society and The Conservation Foundation, we were to meet with the Grizzly itself at rather long intervals, and the signs of its presence always.

Our friend, Dr. Donald MacLeod of Jackson Hole, had come up to visit us for a couple of weeks. One day he and I went west of the Sheenjek River and late in the day climbed into a pass behind what we had called First Mountain. And there, below a distant ridge, we spied a Grizzly, lying down on a gravelly slope. We both carried small kodachrome cameras, and Don also had an 8 mm. movie camera. But the bear was out there in the open, on a bare hillside. How could we ap-



By OLAUS J. MURIE

President of The Wilderness Society

proach him? We knew that Bob Krear was up on that mountain somewhere, and we wondered if he might not come down that same ridge.

A few moments later Bob appeared on the skyline. We waved at him, and even at that great distance caught his attention and frantically pointed over toward the bear. We learned later that Bob had already seen the bear, and had begun to approach him for pictures.

Bob was moving cautiously down the slope, but the bear suddenly saw him, jumped to his feet, and came toward him at full speed. With remarkable presence of mind, Bob ran at *his* full speed to one side, in order to get the bear downwind and give him his scent. It at once became a race, the bear for Bob, and Bob for the windward goal. And Bob made it first. At about fifteen yards' distance, the bear suddenly put on all his foot-brakes. He had got the scent. He reversed himself with a great "Whoosh!" and went pell-mell down the mountainside, straight for Don and me. But he saw us, in time, realized that the landscape was full of *Homo sapiens*, and

veered off and disappeared over a ridge at full speed. Cameras were snapping, but in the excitement none of us got a decent focus.

A similar experience with the Alaskan Brown Bear years ago in southern Alaska, when I was also seeking pictures, made me sympathize with Bob's feelings. They usually result in violent nervous trembling all over the body when the crisis is past!

There have been many close calls and some fatalities in man's contact with the Grizzly through the years and it behooves us to try to understand them. Some years ago a man with torn scalp and wounds in one arm told me of his experience near Mt. McKinley National Park. There was snow on the ground in late fall and he and a companion had wounded a Grizzly. A little

Grizzly Bears roam the Sheenjek River valley in the Brooks Range of Alaska. Here the author spent the summer of 1956 to observe the animals and the ecology of the wilderness.

Photographs by the author unless otherwise credited

later they decided to follow the tracks. My informant was in the lead, on snowshoes, with mittens on his hands, and his gun on his shoulder. In that condition he led the way into thick brush after a wounded Grizzly!

Suddenly the wounded animal arose right in front of him. With lacerations on head and arms, the man fell backwards and swung his snowshoes up in the air. The bear promptly smashed the snowshoes with his paws. By this time the hunter's companion got his gun into action and killed the bear. Obviously, in this case the man asked for it, and got it.

Hunters are still being injured and killed in encounters with Grizzlies. It is significant that the Izaak Walton League chapter at Anchorage, Alaska, has made a campaign against hunting from airplanes and such unsportsmanlike methods of bear hunting as bombing a bear out of its den. Too many people, with complete reliance on their guns and equally complete ignorance of fact, like to shoot a bear at close range. A fatally wounded bear will often run twenty yards or more and can do terrific damage before falling. Years ago I shot a number of Grizzlies and Brown Bears for the National Museum. I always shot at some distance, and I learned never to be



downhill, under a bear, for in his final rush the animal will go downhill.

But how about the times when you are not out to kill a bear? Things can happen then, too, for almost anyone will admit that the Grizzly is a powerful beast, is impulsive, and can be dangerous. But one important precaution can be taken: *Try to let the bear know what you are.* The bear's eyesight is not very keen, but it has a very good nose. Oldtime Alaskans, who knew their way around, when travelling through brushy or wooded bear country would bang on a pan occasionally, to wake up any stray bear and let it know that someone was there. One time when I was letting our empty canoe down the shallow waters and riffles of a stream in Yellowstone National Park, Mrs. Murie was walking down a trail parallel to the stream. We knew there were Grizzlies in that area, and she kept whistling and singing, no doubt in memory of similar experiences in Alaska.

Like all other wild animals, Grizzlies do surprising things. One day in Mt. McKinley National Park I found a Grizzly mother with two cubs, low on a slope, digging out a Ground Squirrel. I carefully approached with the camera and got down fairly close, with only a ravine between us. When I snapped the Graflex, she heard the sound and looked across at me. Leaving her cubs behind, she immediately ran up the high slope

ABOVE — The Grizzly leaves unmistakable signs of his passing; here a bear has excavated the burrow of a Ground Squirrel. RIGHT — Ground Squirrels are sought for food by the Grizzly, Red Fox and Lynx, and in some parts of Alaska the Eskimos cure skins for parkai.

and disappeared over the ridge. I whined like a cub in distress, for her flight emboldened me for a try at another picture. At the sounds, she reappeared on the ridge top and looked down in my direction, then disappeared again. The two cubs were left to make their way up the steep slope on their own.

On another occasion some hunters had managed, somehow, to capture a Grizzly cub alive and the mother ran away. Because they wanted to shoot the mother, the hunters pinched and hurt the cub to make him squeal, but in spite of the cub's outcries she never returned.

A few years ago in Mt. McKinley National Park, three of us were climbing high up on Sable Mountain. Presently a small band of Mountain Sheep came toward us along a ridge. With a telephoto lens on a 35 mm. camera I took several pictures. The sheep paused on the slope above us and I decided to take one more picture. While I was getting the focus, peering through the finder, I was startled to see a Grizzly Bear walking into the picture. When he was just below

the sheep, I did have the presence of mind to press the shutter. The sheep calmly went about feeding, and the bear walked on, apparently oblivious of what was in the landscape, and went over the ridge into the valley beyond.

During our sojourn last summer in the Brooks Range we wanted to learn how the Grizzly lives in this farthest north range. Of course, we know that Black Bears and Grizzlies, including the so-called Alaskan Brown Bears, are chiefly vegetarians, despite their fierce canine teeth and powerful front legs. Nevertheless they overlook no chance to eat fish, carrion and any other meat they can find. Referring to the more southern Alaskan Brown Bears, someone remarked, "They graze like cattle." During the summer I collected droppings of Grizzly, Wolf, Red Fox and Lynx,

as part of our effort to understand the ecological relations of the animal life in this precious wilderness of the Arctic.

Everywhere we went we saw the diggings where the Grizzly had excavated for roots, which here constituted the number one item in its diet. Only second to this were the green sedges and grasses. In the proper season all kinds of bears everywhere, like the human inhabitants, enjoy berries. In the Brooks Range these were blueberries and buffalo berries mostly, and some alpine bearberry. However, in more southern areas apparently the green plants form the preferred item and roots are second. This would appear to be logical considering the short growing season in the Brooks Range — a clear adaptation to climatic factors.

Of course the bears get an occasional Moose or Caribou calf, some young birds and occasionally the eggs of birds like the Ptarmigan, and the remains of animals killed by Wolves. But there is one habit common to bears everywhere. Here in the Brooks Range, too, the bears had the habit of digging out the dens of Ground Squirrels. They cannot catch these little animals in the open, but with their powerful paws they can roll out rocks, sometimes of enormous size, and dig down to

Caribou on the east fork of the Chandalar River. Dr. Murie believes the area contains as many Caribou as it should hold, for there is a striking scarcity of the lichens the animals eat.

Photograph by George Shaller



where the Ground Squirrel lives. In coastal areas bears have an opportunity to catch many migrating salmon, but in the Brooks Range, where they do not have this kind of opportunity, fish are only an occasional part of their diet. In only four instances had Grizzlies fed on Grayling. Nor do they find ants or as many bees and wasps as they do further south.

A collection of 137 fox droppings gave us an idea of the food habits of this smaller inhabitant of the Grizzly's Arctic world. Although he will occasionally eat a bit of grass, as the Coyote and the dog will do, he is a true carnivore, living chiefly on Ground Squirrels, mice and Ptarmigan. Like the bear, the fox will now and then find a young bird or eggs, Muskrat and the like.

The Lynx also had similar habits, feeding largely on Ground Squirrels and Ptarmigan and somewhat fewer mice. It should be stressed here that at the time of our study, the summer of 1956, the Snowshoe Rabbit population was at the

low point in its cycle. In the years when those rabbits are more numerous, rabbit is an important item in the diet of both the fox and the Lynx.

But when we come to the Wolf we find a different story, and an important ecological coordination among all these carnivores. I found only 41 Wolf droppings, but these, together with our observations, showed that the Wolf diet is mainly Caribou — 38 of the 41 samples. The Wolf will get an occasional Ptarmigan or Ground Squirrel.

Here is a principle which may be of some importance in the economy of these carnivores. We do not know how long a Caribou furnishes food for Wolves. When I was driving dogs some years ago we used to have in mind that a large husky dog would eat about ten pounds of Caribou per day, and Caribou will average 150 to 200 pounds; that is, those animals the Wolf is likely to kill. But before a Caribou is consumed a Grizzly Bear may find a carcass temporarily abandoned. There were at least 19 such instances in the 125 Grizzly dropping samples I collected. The fox apparently is even more alert to this sort of carrion windfall, for out of 137 fox scats collected, such Caribou carrion left by wolves was eaten at least 28 times.

This picture of a Grizzly female and her cub happened to be made in the Mt. McKinley National Park, but similar scenes can be observed in the vast, wild Sheenjek River Valley.

Photograph by Adolph Murie



A Grizzly Bear slept here. This is the hibernation den of one of the big mammals, scooped out of the hard earth on a mountainside in the Brooks Range as a snug harbor for his winter's sleep.

Photograph by Robert Krear



The Lynx had the same habit. Of 23 scats, 12 showed remains of Caribou. This source of food, furnished by the Wolf, must have been most welcome to both the fox and the Lynx in such a time of rabbit scarcity.

And what of the Caribou, which through the Wolf furnished this cooperative food supply? We carefully looked over this range and there was a striking scarcity of the lichens of the species Caribou enjoy. The herds were constantly on the move, thus conserving the food supply, I am convinced. It would seem that the area contained as many Caribou as it should hold. And the observations of students of Wolf habits agree that the Wolf, on the average, will pick off the lame and otherwise slow or disabled animals.

It has been generally known for a long time that the Arctic Fox on the ice of the Arctic Ocean will glean considerable food by alertly watching for the remnants of carrion left by the more carnivorous Polar Bear. Here in the Brooks Range we found a similar sort of partial "commensalism," contributing to the lives of the Red Fox, Lynx and Grizzly Bear. The benefactors in this kind of ecological arrangement are the Wolf and the Caribou.

What of the future of these animals? In a pamphlet published by the National Wildlife Federation, Robert Cooney declared that our

hope of preserving the Grizzly Bear lies in our wilderness areas. More recently Dr. John Craighead of the University of Montana said the same thing. There can be no doubt about this.

As for the Wolf and the Caribou, there again we must rely on wild country. Moreover, we must begin to realize that such animals as the Caribou require food — and that we must have better understanding of range requirements. The Wolf is a persecuted animal which is being pushed off our continent, slowly, by traditional hatred. Wild country and a better understanding of ecology are our hope.

Our summer's work in the Brooks Range, especially on the Grizzly Bear and his carnivore associates and on the Caribou and the plant growth, demonstrates clearly one of the great values of such areas of wilderness. Here the scientist, especially the ecologist, be he professional or amateur, has the opportunity to study the interrelationships of plants and animals, to see how Nature proceeds with evolutionary processes. Add to this the opportunity for all who are sensitive to natural beauty, who like to see the Caribou, the Fox and Ground Squirrel, and perhaps a glimpse of a Wolf, in their own unmodified world. These places will be precious not only to us, but even more so to the people of the future — if we can hold the wild country for them.



THE FRIENDLY BICOLORED ANT BIRD

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

Illustrated by DON RICHARD ECKELBERRY

YOU MAY WANDER far through tropical forest, meeting only here and there a solitary bird. Just as you begin to suspect that the accounts you have read of the splendor and variety of tropical bird life were greatly exaggerated, your attention may be drawn by a chorus of small voices somewhere in the distance. Following the sounds, you come in view of winged figures flitting through the shrubs, low palms and ferns of the dimly lighted undergrowth. It seems that a large share of the feathered inhabitants of the surrounding forest have congregated in this one spot. Most wear subdued colors — browns, olives and grays — which blend with the bark of trees and the dead leaves on the ground. Some perch on low twigs, others grasp slender upright stems, yet others cling woodpecker-like to thick trunks. From time to time they dart rapidly back and forth, or drop momentarily to the ground.

The excited feathered crowd sends forth a medley of churrs, cheeps, rattles, whistles and trills, and in intervals of relative silence the keen ear may detect a low, rustling sound, made by countless tiny feet pattering upon fallen leaves. Looking down, one sees that the ground beneath the birds is covered with swarming ants — dull brown, sightless army ants. As the hunting ants push beneath fallen leaves and file up the trunks of trees, all the small creatures that hide in such places make a dash for safety. Crickets, roaches, moths, centipedes, spiders, an occasional small frog, lizard or snake, rush forth from conceal-

ment, and many which escape the ants are snatched up by the attendant birds. It is the ease of finding food above the foraging army that has brought together this motley crowd of feathered creatures.

Conspicuous among the followers of the army ants in the lowland forests of southern Central America is a bird about the size of a sparrow, clad in rich chestnut-brown upper plumage, with a broad, somewhat irregular band of white along the central under parts from the chin to the abdomen. Each large, dark eye is set in an area of bright blue bare skin, below and behind which the cheeks and ear-coverts are black. It stays within a yard of the ground, clinging to slender vertical stems in preference to horizontal twigs. By stretching out the upper and flexing the lower of its bluish-gray legs, it manages to hold its body almost upright despite its peculiar manner of perching. Whenever its keen eyes espy some small invertebrate desperately trying to escape the ants, it darts down and seizes the fugitive, returning in a trice to an erect stem with the victim in its blackish bill. It is a voluble bird, constantly repeating its half-whimsical, half-mocking call, which consists of a series of little clear notes rising in pitch toward the end: *we we we we we we we wheer*. Or sometimes two or three notes falling in pitch terminate the series — this call has many variations. Often three or four, and sometimes as many as six or seven, of these attractive birds gather about a swarm of ants, with many associates of other species.

As I walked through the forest on my farm in Costa Rica, one cloudy morning in February about fourteen years ago, I noticed a lone Bicolored Antbird in the undergrowth close beside

The Bicolored Antbird is a voluble and friendly follower of the columns of army ants. Typically it is found within a yard of the ground, clinging to vertical stems rather than perching on horizontal twigs.

the trail, and it stayed so persistently in one spot that I was led to look for its nest. I searched the more eagerly because I had never seen the nest of this species, although I had hunted much for it in forests where the bird is fairly abundant. While I peered into the hollow center of a palm stump and scrutinized the crevices between its crowded prop-roots, the antbird appeared to be examining me from the bushes only a few feet away. But I found no nest. As I began to walk away, the antbird followed me. Moving slowly and watching it out of the corner of an eye, I saw that it was snatching up the insects driven from the fallen leaves by my passage. Taking care to shake the ground litter and to avoid abrupt movements, I led it through the undergrowth for nearly a hundred yards, a leisurely journey on which it was rewarded by many small creatures that it ate. Clearly it was using me in lieu of army ants to stir up the insects so difficult to find as they lurk motionless beneath fallen leaves with whose color they blend.

This was the first of many similar excursions that the antbird and I took together. As we became intimate, I needed a name for my little woodland friend, and "Jimmy," short for *Gymnopathys bicolor*, seemed as good as another. As we walked together through the forest, I would repeat this name in order to accustom him to my voice. But I was doubtful as to the appropriateness of this masculine appellation, for the sexes of the Bicolored Antbird look very much alike, and "Jimmy" might well have been a female.

Sometimes as I walked through the woodland near the house I found Jimmy, but far more often he found me. While I stood watching some other bird he might apprise me of his presence by a low, questioning note, and looking down I would see him clinging to an upright stem, a foot from the ground and hardly a yard away. Often he would wait patiently close by me, perhaps preening his feathers, until I finished my observation of the other bird. Then, if I could spare the time, we would begin the leisurely journey which he liked, for he would not try to keep up if I walked fast. Frequently I used a stick instead of my shoes to stir up the ground litter. Whenever a suitable morsel was exposed, Jimmy would dart up and seize it with a *clack* of his bill. He had definite preferences and paid no attention to certain in-

sects which to me looked just as appetizing as those which he eagerly devoured. Among the creatures he disdained were certain moths, although he ate other kinds of moths. In the wet season he varied his diet with small frogs, an inch or less in length, which he beat against his perch before he swallowed them. If he saw an escaping insect dive beneath fallen leaves, he would alight on a low twig or the ground and flick them aside with rapid sideways movements of his bill, just as ant-thrushes, antpittas and many other ground-feeding birds do. Sometimes while seeking a fugitive he would fall some yards behind me, but soon a rapid flight, low above the ground, would bring him to my side again. Or if I delayed too long in one spot, he would remind me of his presence by repeating his low, throaty note while clinging to a sapling close beside me.

In the breeding season Jimmy sometimes followed me while I searched for birds' nests to study, but these trips were more profitable to him than to me, for they provided many insects for him and rarely a nest for me. At times our journeys together lasted an hour or more, and once we went an estimated half-mile, which seems a long distance in the forest. This must have taken Jimmy far beyond his home area. Although he refused to follow when I returned along a little-used wood road, he apparently had no difficulty in finding his way home, and a few weeks later I met him in the part of the forest where he lived.

He could not be enticed beyond the border of the heavy woodland into the brighter light of neighboring second-growth thickets or pastures, although here I might have chased up fat grasshoppers for him. Although he picked up insects at my feet, he always flitted away when my advancing hand was a few inches from him and never permitted me to touch him. Yet he did not object when I ruffled his feathers with the end of a short stick. After he had become thoroughly accustomed to me, I tested his reactions to noises and found him unmoved by my loudest clapping or shouting. Nor was he alarmed when I shook the sapling to which he clung. He was not estranged by a long separation, and after an interval of several months in which we did not meet he would come to me as though our last meeting had been yesterday. No other free bird has ever been so intimate with me.

Since I had neither known nor heard of any other Bicolored Antbird or bird of any kind which followed men through the woodland, I concluded that Jimmy was an original genius who had discovered that featherless bipeds may be utilized as purveyors of food, just as Cattle Egrets and anis use cows, horses and other grazing animals to stir up insects and in the East certain hornbills are said to employ arboreal monkeys. My walks with Jimmy extended over a period of sixteen months, after which for nearly three years I could induce no antbird to follow me. I missed his quiet companionship on my solitary woodland walks.

Then one day a Bicolored Antbird followed me much as Jimmy had done. Considering the long period when no antbird had accompanied me, I concluded that this was a different individual, perhaps a descendant who had inherited Jimmy's peculiar trait. Hence I called him "Jame-son." In subsequent years, I have from time to time been followed through the forest near our house by Bicolored Antbirds and sometimes by two together, apparently a mated pair. It is possible that Jimmy started a custom which has been spreading through the local population; but we should need to know far more about the habits of the species in other parts of its range before passing final judgment on this surmise. Sometimes young Bicolored Antbirds, easily recognized by their darker under plumage and the yellow corners of their mouths, have come almost within arm's length and even followed me for short distances, but they could never be induced to take a longer trip and catch the insects I stirred up, perhaps because they still received food from their parents, who were near by. They were either curious or simply friendly.

At times, especially in June, the antbirds who followed me, instead of eating at once the food they caught, would carry it off through the underwood, suggesting that they were feeding young. To my great disappointment, I never succeeded in following them to their nest, if nest they had. But as I passed along an indistinct trail in the forest near our house in mid-August, a Bicolored Antbird clung to a stem close beside me with a fat insect in its bill, repeating over and over a low, scolding *churr*. This led me to begin a search through the undergrowth, and as I

moved about the bird darted so close to me that its wing brushed my leg. Then it dropped to the ground, grovelling and beating its half-spread wings, in an excellent distraction display. It "feigned injury" repeatedly in various spots only a yard or two from my feet.

Finally I discovered two nestlings lying close together on the ground, as though they had been tumbled there. They seemed to be about five or six days old, for they bore long, lead-colored pinfeathers and their eyes were already open. They had great, white flanges at the corners of their mouths. They were cold and sluggish in their movements, and one had fresh blood on its flank.

A little more searching disclosed whence they had come. Near by was the stump of what had been a tall feather-palm. It was only about six inches high, and all the central part had decayed away, leaving a deep hollow surrounded by a papery shell. The frail stump had somehow collapsed, spilling nest and nestlings onto a palm frond that lay close beside it. The nest had consisted of large pieces of partly decayed palm leaf, forming a thin mat, above which was a lining of coarse fibrous roots and similar materials.

While I examined the remains of the ill-fated nest, the parent behaved in most extraordinary fashion. It gulped down with an effort the fat insect it had been holding and with empty bill incessantly repeated a somewhat churred *per-r-r-r*, at once plaintive and protesting. Several times more it grovelled on the ground in front of me, beating its wings in an effort to lure me away from the nestlings. When I held them in front of the parent in the palm of my hand, it advanced and bit a finger three or four times, but not hard enough to hurt. With the exception of a female Slaty Antshrike, who nipped the finger I placed on her nest while her mate "feigned injury" on the ground to lure me away, no other forest bird has ever dared to attack me. Spreading a handkerchief on the fallen leaves, I placed the torpid nestlings on it while I arranged a new home for them. The parent lay or sat on the ground facing the handkerchief with its youngsters and remained motionless, watching or guarding them, for the ten minutes or so that I left them on the leaves.

After I had improvised a sort of nest in the hollow sheath of a palm frond, I placed the nestlings

in it while the antbird intently watched me. Then I went away, confident that so devoted a parent would not neglect its little ones. But when I returned next morning they were both dead, one in the palm sheath, the other lying on the ground close by it.

After this, I looked into every hollow palm stump that I found, and also into the long, almost cylindrical sheathing bases of great fallen palm fronds, for Dr. Josselyn Van Tyne had a short while before published an account of the discovery of a Bicolored Antbird's nest in a similar situation in Panamá. The following May, not far from the point where I had found the fallen nestlings, I peered into a low palm stump to behold a Bicolored Antbird sitting in it and returning my gaze. It stared up at me for nearly a minute, then jumped out and "feigned injury" on the ground close in front of me. Its departure revealed two creamy eggs, thickly marked with elongate blotches of rufous-chocolate, which lay on a nest composed of a double handful of leaf fragments, with a thin lining of rootlets and other fibrous materials. The stump, about ten inches high, had been reduced by decay to a thin shell, so fragile that I did not dare insert a hand into the deep, narrow cavity in order to pick up and measure the eggs. All the while that I examined the nest and made notes, the antbird circled close around me, voicing a churred *per-r-r-r* punctuated with a higher, sharper note. Once it tried to lure me away by approaching within arm's length and then walking in front of me with little, mincing steps. When finally, having completed my note-making, I walked off, the parent followed for a yard or two. Then at once it went to look into the stump to see whether its eggs were still there. It made a second examination, then while I stood watching a short distance away it returned to incubate. Rarely have I seen a bird evince more obvious concern for the fate of its nest.

Setting up a blind, I spent two whole mornings and all of an afternoon studying the antbirds' mode of incubation. The sessions on the eggs were amazingly long even for antbirds, which as a family sit for longer periods than songbirds. One morning a parent incubated continuously from 6:25 to 12:04—nearly six hours. On another morning I timed a session which lasted

four hours and four minutes. These were long fasts for a small bird. Afternoon sessions were shorter, but one was continued for about three hours. Yet I never saw one parent replace the other. Sometimes after sitting for hours the bird would go off, leaving the eggs unattended. At other times the mate would come and call the sitting bird from the nest, then both would fly away together. In either case, the eggs might be neglected for periods ranging from five minutes to an hour and a half. Often the bird returning to the nest brought a rootlet or fiber to lay beneath the eggs.

Since I was unable to distinguish the members of the pair, I could not tell whether incubation was performed by the male, the female, or by both sitting alternately. Remembering that Jimmy would permit me to touch him with a stick, I wrapped a little cotton about the end of a long wand, dipped it in paint, and touching the parents as they flitted close around me protesting my intrusion, I placed white stains on one and some vermilion spots on the other. Continued watching of the marked birds left no doubt that both male and female took turns warming the eggs, as seems to be the invariable procedure in the antbird family. In those species in which the sexes differ in coloration, it is not difficult to convince oneself that the female regularly takes charge of the nest by night. The bird on whom I had placed the white marks sat through the night, hence I inferred that this was the female.

Fourteen days after I found the eggs, I visited the nest by moonlight, and looking into the stump with the aid of an electric torch, I saw a mass of feathers so loosely spread and disheveled that they appeared not to be attached to a living bird. Such complete relaxation of the contour plumage is typical of antbirds sleeping on their nests. The parent with the white marks continued to slumber while the light increased and the woodland birds gradually became active. Even after awakening she would not leave when I bent over her and tapped gently on the side of the stump. Soon weak peepings filtering through the maternal coverlet told me the cause of this increased attachment to the nest. When finally she jumped out, it was to grovel at my feet in realistic "injury-feigning" acts repeated again and again, until I put an end to them by with-

drawing a few paces. Then the parent promptly returned to her newly hatched nestlings. The empty shells had not yet been removed.

The young antbirds had dark flesh-colored skin wholly devoid of down, and the interior of their mouths was orange-yellow. On the second day after they hatched they were fed eleven times between daybreak and noon, seven times by their father and four by their mother. On each visit the parent brought a single insect, which it held in its bill and delivered while it clung inside the stump in an inverted position, its tail in the air. Both parents took turns brooding the nestlings, each of them sometimes sitting well over an hour at a stretch.

When the nestlings were five days old, they bristled with long pinfeathers and their eyes could be opened, although most of the time they

drowsed with closed eyelids. Their parents had by now simulated injury before me dozens of times—far more than any other birds I have studied. Yet when a predator arrived their wiles failed to save their nestlings, possibly because it came in the night. I returned on the sixth day after the young hatched to find that their nest had been raided, as happens to the great majority of the nests that one discovers in the tropical forest. But from the tremendous loss of eggs and nestlings one may deduce the pleasant thought that the adults must be long-lived, for otherwise they could not rear enough progeny to replace themselves and their kind would vanish from the earth. It is now nearly nine years since these nestlings were lost, and since then I have not succeeded in finding another nest of the friendly but secretive Bicolored Antbird.

LIFE WITH MOTHER

By MARGARET ALTMANN

Moose & Elk Researcher, Jackson Hole Biological Research Station



This is an orphaned Moose calf in Jackson Hole Wildlife Park; otherwise its mother would not have permitted a near approach.

DEEP IN THE WILLOW-STUDDED DRAINAGES of the Continental Divide country you may be fortunate enough to witness a striking sequence of events, if you can refrain from shouting and letting yourself be seen. Just stand and watch from an overlook point and you may see a big, hulking, cow Moose and her wobbly-legged calf. Newborn, still wet, it is being licked dry by its mother and stimulated by her care and touch. It tries to get up, staggers a few steps and collapses like a toy animal.

Nursing and shielding the calf from cold and intrusion keep the cow busy during the first few days. When other animals or a human being disturb the scene, she will dodge or try to be inconspicuous by lying low and still.

Soon she will have the calf up and around. By this time it can "heel" and it stays close behind her, gamely stalking over branches and ditches in the willow-aspen habitat. Many weeks pass with first shorter and then longer "heeling" expeditions. One day the calf will be led through a shallow stream and soon it swims by the cow's flank through deep water to an island or the other shore. When the cow feeds on algae in a pond, her calf is "parked" on the shore in full sight of the mother.

By now the cow has territorial feelings. She will not tolerate other Moose passing by, sniffing at or staying near the calf. She will walk up to the intruder and with ears folded back, head outstretched forward, indicate that she is going to act. This gesture is so well understood that most animals detour the area. In the rare cases when an intruder does not retreat at once the infuriated cow strikes with her heavy front feet, and even a huge bull Moose or a prowling bear will retreat after a few blows in rapid sequence. I recall one grazing horse, crossing a small island in search of better pasture, that was pursued by an angry cow. A battle in the water ensued. The Moose hit so hard that the horse nearly drowned and when it eventually reached the opposite bank it was a shaking picture of defeat. Campers in the wilderness do well to avoid getting between a cow Moose and her calf, too. It may happen that the youngster walks right up to you or follows you. In a few seconds you will hear a cracking in the thicket as the mother charges up to retrieve her calf. Such a thing can happen easily, for the natural tendency of the calf to heel is easily transferred from the mother to other big creatures. If the cow is killed or lost, the calf will adopt someone else, often to its own great detriment.

Gradually, as the summer progresses, the distance between cow and calf widens. The urge of the calf to explore and play around is not prevented by its mother. It is surprising to see how much leeway she gradually gives to the young one that previously was kept so strictly by her side. The time comes when she patiently waits in the timber while the distant calf, not noticing her departure, suddenly gets scared, sniffs and searches, and with some self-reliant effort finds her tracks. Thus the bond necessary for the protection of the calf is reinforced and adapted.

The habitat changes; the Moose drift up to higher altitudes where there are fewer insects and disturbances, but the area around the Moose calf is still defended and carefully screened by the cow. Now even yet is the calf allowed to meet and mingle with other Moose. When does this exclusive "life with mother" come to an end?

In September, when the rutting season of the Moose begins, the situation changes. The first "stranger" that the calf meets and learns to know is a bull Moose that comes to court its mother. The calf's meeting with the big bull is a turning point in its life. For the first time the cow does not exhibit her territorial defense reaction, and it is obvious to the calf that something is different. Trembling with excitement, it shows signs of curiosity and caution when it sniffs the bull's face. Fortunately the bull at this time is so enchanted by the cow that he is tolerant and friendly to her calf.

The nursing period is tapered off in the fall, but in contrast to many other animals the calf remains dependent on its mother's care for another year. Now a strapping, ungainly youngster, it nevertheless gets guidance and protection, although not always at such close quarters as before. The bond of communication works at a greater distance and brings warning as well as encouragement to the young Moose. Very little vocal exchange is used. The signals are by gesture, posture and gait, some of them only noticeable to the trained eye of a human observer. A lifting of the head, an ear moved forward and one back, can be a warning. Freezing — that is, motionless stance — can be signal for imminent retreat in flight.

A critical time comes for the Moose yearling in spring, when a new calf is born. Suddenly the cow becomes solitary and drives the yearling out of the close circle. This is done in most cases without bodily violence, just by a threatening gesture. The yearling must not come close and bother the newborn calf. After several unsuccessful attempts to break this rule, the yearling becomes resigned and stays in the fringe area, obviously taking its displacement very hard.

Many months later, when other groups of roaming, unattached young Moose drift by, it may join them and start a life of its own. Life with mother has served its purpose.

AQUARIUM PREVIEW!

Photos by SAM DUNTON



A FEW OF THE FIRST GUESTS IN STAGE ONE OF THE AQUARIUM

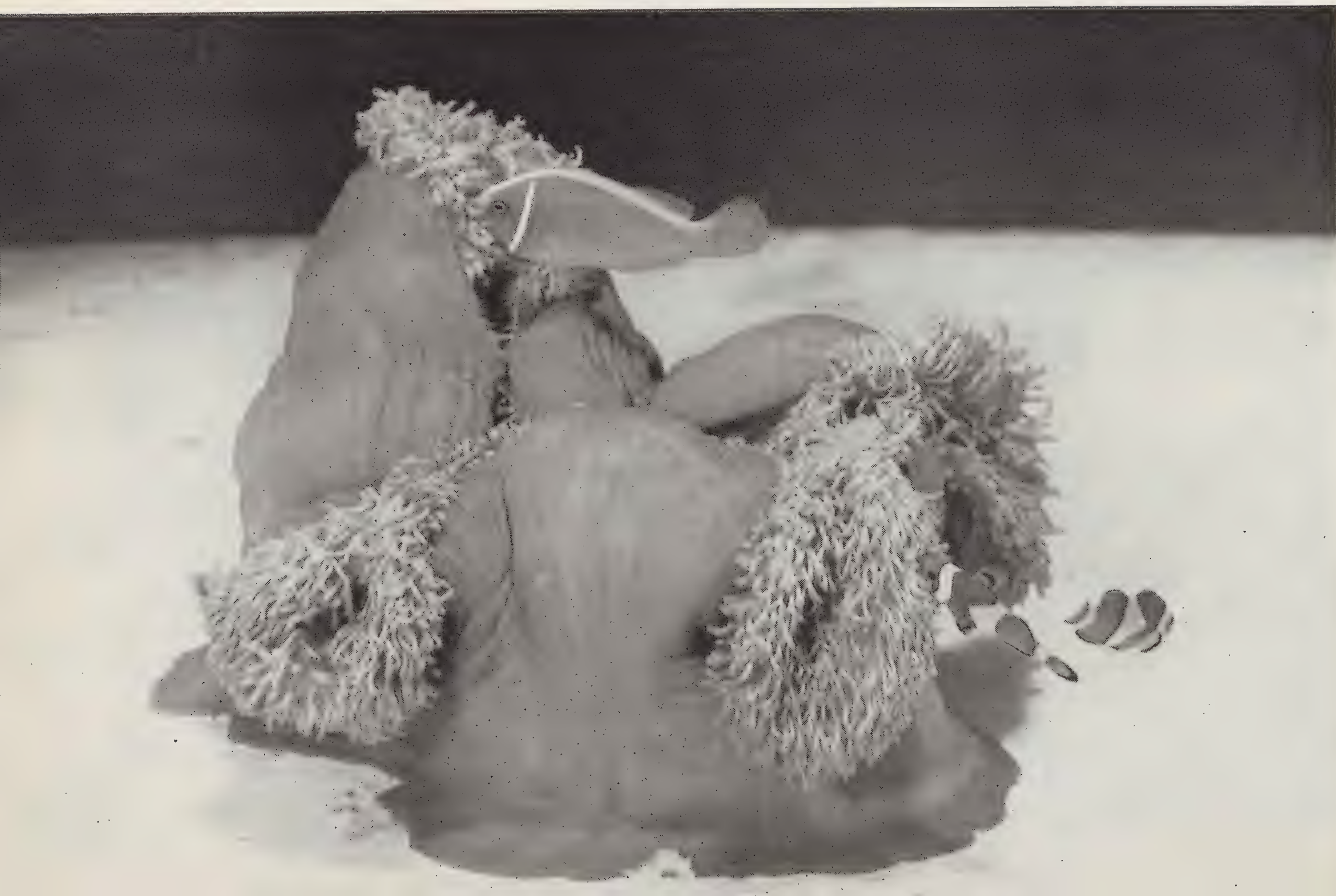
These are typical reef fishes that the Aquarium is getting from Florida and the West Indies. At the top is a Long-tailed Filefish, *Alutera scripta*, one of the largest and handsomest of the Filefishes — despite the fact that it always looks chronically underfed. Below is a Spadefish, *Chaetodipterus faber*, closely related to the Angel Fishes. Next is a specimen of the Nassau Grouper, *Epinephelus striatus*, in one of the commoner of its many color patterns. This species has as many as eight color patterns, and an individual may change several times a minute, as its emotions vary. At the bottom is another Spadefish.



A very prickly customer is the Spiny Boxfish, *Chilomycterus schoepfi*, which is related to the puffers and porcupine fishes. It reaches a length of 10 inches.



This object that look like the tanned skin of some animal, with only part of the hairy side showing, is a Sea Anemone and the small fishes hovering nearby are kinds that are not harmed by its stinging cells.





Seahorses, *Hippocampus hudsonius*, are probably the favorites of most visitors to an Aquarium; certainly they always have fascinated spectators around the tank. The new Aquarium has a nice "stable" of them.



More than 30 different common shrimps are found along the Atlantic coast — and many more rare ones. This shrimp was collected off the Florida coast.

A young Oriental Sweetlip, *Plectrohynchus orientalis*, the first of the species the Aquarium has ever exhibited. It is strikingly marked in rich mahogany, cream and yellow. This one came from the Philippines, from where we are now getting frequent shipments.



Our Hawaiian-hatched Panamanian Poisonous Frogs

By JAMES A. OLIVER

A SMALL Chocoano Indian boy squatted on his haunches beside a fire in eastern Panama. His mind was agitated by feeble twinges of curiosity as he picked up a twig and carefully scraped a tiny object from the edge of the coals. Reaching down beside him he picked up a lightweight, straight-shafted arrow and drilled its point into the soft, shriveled, dark thing salvaged from the fire. After several arrows had been treated, he kicked the small object into the coals with his calloused toes. His weapons thus readied, he went forth on his evening hunt and soon flushed an agouti, one of the succulent rabbit-like rodents of tropical America. He drew his bow slowly and shot with accurate marksmanship and his arrow struck the animal's flank, starting it up like a flash. It ran several yards down the trail and fell over, quivering a moment and then becoming still. The boy picked up his quarry and carried it back to the village. As he walked along he wondered admiringly about the magic on his arrow that had proved its effectiveness once again by quickly killing the agouti before it could run away.

What *was* this magic and what was the object from which it was obtained? Several Indian groups in tropical America have learned that some species of small frogs have a highly toxic skin secretion, and that if the frog is heated or dropped into a fire it will secrete an extra amount. They know that by rubbing this toxin onto the ends of their arrows or blow-gun darts they can quickly and effectively knock out an animal.

The use of the poison has been known for many years but the exact nature of its effective elements is still poorly known. In fact, the skin secretions of the common toads of the genus *Bufo*

are much better known. Dr. C. G. Santesson of Stockholm experimented with the poison scraped from blow-gun darts. He found that it produced paralysis of the central nervous system and of the heart, and that very small doses quickly caused death in small mammals by paralysis of the respiratory center, and suffocation.

Another use of this frog's skin secretions has been reported in scientific literature but requires confirmation because it seems highly improbable. This is the "dyeing" of the green Amazon Parrot. As reported by Hans Gadow in 1901, this is done as follows: "The green and blue feathers on the head and neck, or other parts, according to the fancy of the operator, are plucked out, and these places are rubbed with the poison, often simply with the living frog, certainly not with its blood, as is sometimes asserted. This operation may be repeated when the new, young feathers begin to bud. The result is that these appear yellow instead of green, and since the Brazilians, and to a certain extent the Portuguese, are rather partial to these artificially-produced freaks or *contrafeitos* as they call them, the industry is kept up." This report has been repeated in the literature, but seems to be without verification.

The object raked from the fire by the Indian boy was a small frog and, in the case of our Chocoano boy, it was a frog usually referred to as the Panamanian Poison Frog, *Dendrobates auratus*. This frog is a member of a family of interesting, small and colorful frogs inhabiting the leaf-littered forest floors of lower Central and northern South America. In addition to their potent skin secretions many members of the family are noted for their quaint reproductive habits, wherein papa is the nursemaid.



The species *auratus* occurs from eastern Panama north into Nicaragua, including the Panamanian islands of Taboga and Taboguilla. It is a black frog with rounded light markings of pale golden-green or gray-green. In the past it has been confused frequently with *Dendrobates tinctorius*, one of the commonest species and one whose scientific name reflects the poisonous nature of the skin secretions. This species is black with light longitudinal stripes. The Panamanian Poison Frog has a head and body length of about one inch — a true giant of the species might reach an inch and a half. Females attain a larger size than males. Unlike most species of frogs, these lilliputians are active during the daytime and are found almost everywhere through the forest, not being confined to the vicinity of streams. The late Dr. E. R. Dunn of Haverford College contributed greatly to our knowledge of these frogs and their relatives. He found them to be most active in the mornings after rains. Dr. Dunn described their call as “a low, soft, buzzing sound.”

On the basis of his studies in Panama Dr. Dunn described the mating activities in detail:

The Panamanian Poison Frog may be just a source of arrow poison to a Panamanian Indian, but in the Zoological Park's reptile collection it is a living jewel of black and green.

“The call was often given from a slight elevation, such as the highest point of a fallen mango leaf. There was no calling station: the males moved constantly, calling occasionally between hops. Some moved 30 to 40 feet while we watched them. A calling male was usually followed by several females, who sometimes actually jumped on him. The male seemed aware of his suite and if pursuit lagged would halt longer, become more vociferous, and finally disappear beneath the leaves, closely followed by one female, the others having paused by the wayside.” The eggs are apparently laid in small moist or water-filled depressions. The male remains in the vicinity of the eggs and after they hatch, he takes up his role as nursemaid of the tadpoles. He takes the newly hatched larvae on his back and carries them to permanent pools of water, frequently in holes in trees.



A notable thing about the Panamanian Poison Frog is its reproductive habits. The eggs are deposited in moist or water-filled depressions and after they hatch the male takes the tadpoles on his back and carries them to a permanent pool, frequently holes in trees. The females seem to take no part in this activity.

Drawing from Breder

This astounding performance was first reported for any frog in 1857 when Dr. Jeffries Wyman observed it in *Dendrobates trivittatus* in British Guiana. Dr. Wyman erroneously believed it was the female who was carrying the tadpoles and that the entire larval period was spent on the back of the parent. Since 1857 many observers have recorded this behavior in numerous species and have established that only the males do the carrying. Dr. Charles M. Breder, Jr., formerly Director of the New York Aquarium, was the first to report tadpole-carrying in the Panamanian Poison Frog. The number of tadpoles carried on the back at one time ranges in different forms from 1 up to 15, although I am sure Dr. William Beebe has observed a higher number. One observer reported that the males take the larvae on their backs whenever the ponds dry up; however, present information indicates that this is not true. Apparently it is only the young, newly hatched tadpoles that are given piggy-back rides to a permanent pool where they complete their development into the adult stage.

Observations on *Dendrobates auratus* indicate that most often a single tadpole is carried at one time — perhaps because of the relatively large size of the tadpole — and that frequently it is carried to a hole in a tree. In Panama, Dr. Dunn

saw three frogs, each with a single tadpole on its back, moving about on the trunk of a large smooth-barked tree. This tree had a number of small holes containing water. One of the tadpole-carrying frogs disappeared from sight about 40 feet up the tree. Dr. Dunn reported, "All the frogs, in their peregrinations, investigated the water holes and usually went in for a dip. The lower smaller holes contained no tadpoles, and none were left there by the frogs we watched although tadpole-carrying frogs entered water twice, one of them sitting with his head out for six minutes before he emerged still carrying his single tadpole." The occasional dips in pools doubtless help the gill-breathing tadpoles to survive their overland jaunts.

Dr. Theodore H. Eaton, Jr., also recorded interesting observations on this species in Panama. He reported that although the season was exceptionally dry, "water stood in cavities in trees wherever these were exposed to rain, and usually one such hole would contain from one to ten or twelve tadpoles." The smallest amount of water in which he found tadpoles was about a quarter of a cup, the largest about two gallons. For a month and a half he studied and collected larvae at intervals from a single hole four feet from the ground in the first crotch of a tree. This hole had

approximately the shape and capacity of a quart beaker. During the period of study not less than three, and probably five or six, adult males came to the hole to deposit larvae at different times. He recorded one male who backed down into the water, where he floated vertically with legs spread until the tadpole wriggled free. The male then climbed out of the hole.

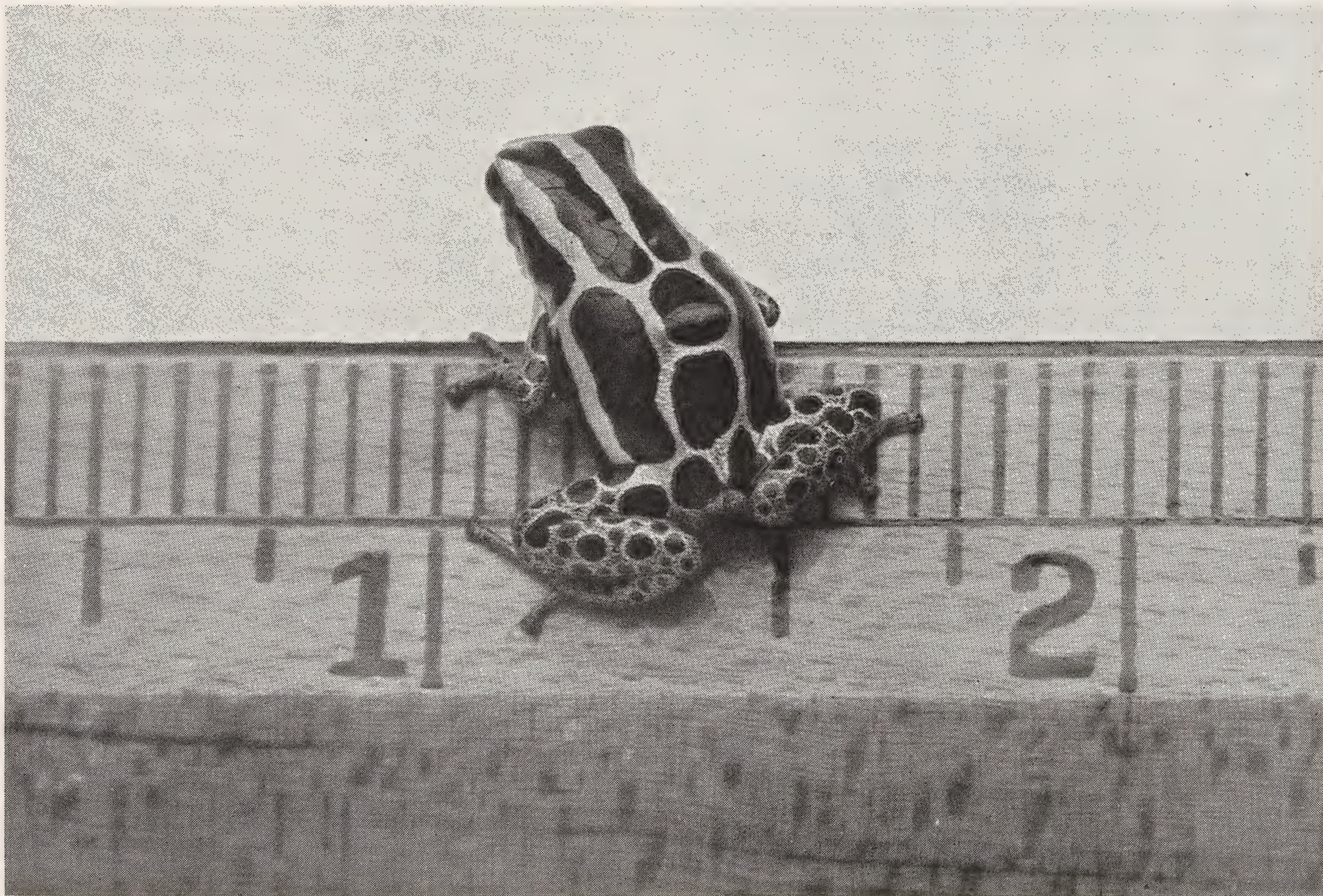
There is no special structure or modification that enables the males to carry tadpoles. Apparently the tadpoles simply hang on with their broad, flattened mouths.

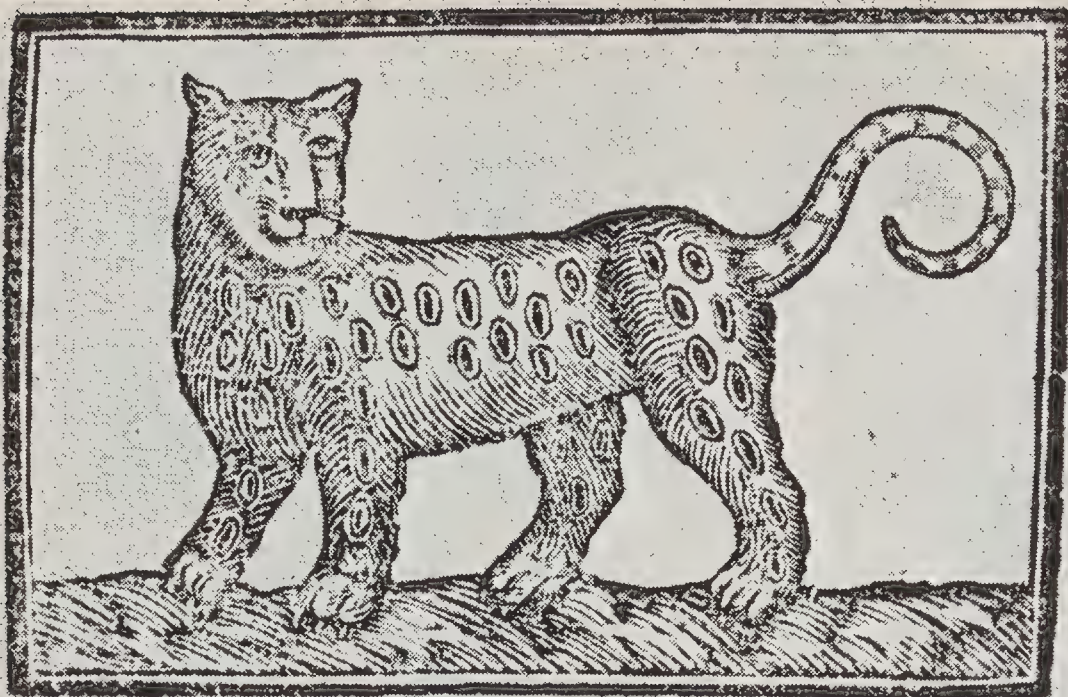
The Indians of Central and South America are not the only ones who have made use of the interesting Panamanian Poison Frog. In 1932 Mr. David T. Fullway took 206 of these frogs from Panama to the island of Oahu in the Hawaiian Islands. He liberated them there in the hope that they would become established and help control insect pests plaguing the islands' crops. The frogs have become established but have not spread very far from where they were originally released. They are at least reproducing in sufficient numbers to maintain a thriving colony.

They have not yet proved a boon for the

Hawaiian Islanders, but their introduction has been fortunate for us at the Bronx Zoo. We like to exhibit this colorful species in our collection, but it seems to be a short-lived species, apparently having a span of only two or three years. When we need replacements it is not easy to obtain them from their native habitat, and customs clearances add to the cost of getting them to New York. However, with the species established in Hawaii and with a cooperative friend in the person of Mr. Paul Breese, Director of the Honolulu Zoo, we can keep a constant supply of the frogs in our Reptile House. Last month when our frogs got down to only two individuals, a letter to Mr. Breese brought a dozen frogs to us by air mail. These Hawaiian-hatched frogs may not be fugitives from the fires of Chocoano Indians, but they serve to help us tell the story of their colorful relatives from the tropical forests of Central and South America.

Often confused with the Panamanian Poison Frog is *Dendrobates tinctorius*, which is also poisonous but which has light stripes. Both these frogs are hardly more than an inch long.





JUST ARRIVED,

And to be seen at Abraham Van Dyck's, in the Broad-Way, near St. Paul's Church, (Price, One Shilling) one of the most beautiful Animals, call'd, The

LEOPARD:

HE is adorned all over with very neat and different spots, black and white; has large sparkling Eyes, and long Whiskers on both Sides of his Jaws, and greedy in catching his Prey by leaping at it. This Leopard is much in Shape, Nature, and Colour, like unto a Panther.

Said Van Dyck has also several other Animals, which will be seen at the same Time. Gentlemen and Ladies may have a full View of the Leopard, as he is well secured with a Chain.

TWO POUNDS REWARD,

RUN-away from the subscriber, living in New-York, a Welch Servant man named William Walters, by trade a mason, six feet high, thin face, red nose, fair complexion, bald on his head, long eyebrows, came in the ship New-Hope, from Bristol; had on when he went away, a blue jacket, new hat, new shoes; he has a wife with him, a Welch woman, both aged about 48 years, and are given much to drink. She had on a brown silk gown, black hat and petticoat; very remarkable in her talk, and is supposed to be gone towards Mr. Griffith's iron works. Whoever secures him so that his Master may have him again, shall have the above reward, and all reasonable charges, paid by

JOHN GIFFORD.

NOTICE is hereby given to the Creditors of the Estate of Jedediah Mills, Clerk of the

and the Particulars very soon advertised; they are to observe, that proper Allowances of Weight shall be given in one of the Purse, by the aged Horner, &c, to those of three, four, five, and six years old, et,

A Leopard guaranteed to be "well secured with a chain" was exhibited on Broadway in 1768, according to a newspaper advertisement.

Courtesy of The New-York Historical Society, New York City

THE FIRST recorded public exhibit of a caged wild animal in New York was advertised as taking place at the Jamaica Fair, in what is now the borough of Queens. In 1728 the Jamaica Fair was held from May seventh to tenth. For a week before that an advertisement ran in the *New York Gazette* telling about the fair, and saying that there "will be exposed for sale a variety of Goods and Merchandise and several fine horses will there be sold. It is expected that the Lyon will be there to be seen."

From the wording of the announcement it appears that the "Lyon" was already familiar to New Yorkers, and had previously been exhibited in the city. If this is so, the proprietor had relied on word-of-mouth advertising, or handbills, and

Long before the Bronx Zoo—

EARLY NEW YORKERS LIKED ANIMAL SHOWS

BY ROBERT & GALE MCCLUNG

had not found it necessary to advertise in the newspapers.

Perhaps this Lion was the same one that had made its first appearance in Boston twelve years earlier. If this is the case, he was certainly a veteran actor by the time he reached Jamaica. In the autumn of 1728 the Lion left New York, and next turned up in Albany. The following year he was seen on the road to New London, traveling in an ox-cart. How many small boys of 225 years ago must have shivered with delight and terror to hear the Lion's throaty cough at night as it was taken from one town to another! This, the only Lion in America at that time, was a worthy forerunner of the traveling menageries and circuses that became so famous a century later.

We have no clue as to how this first Lion was brought to America in the first place. It is likely, however, that it was brought in by some enterprising sea captain or by a sailor who purchased it for some trifling amount of trade goods when his ship touched Africa. The animal may have been acquired when it was a cub, for a pet or as a ship's mascot. Perhaps the man who bought it had enough imagination to envision that everyone would be interested in seeing the "King of Beasts."

Practically all of the animal exhibits that appeared subsequently in the eighteenth century were brought to America in this casual manner. Visitors to the docks became accustomed to seeing sailors with gaudy parrots or chattering monkeys on their shoulders. Gradually other exotic mammals and birds began to arrive in New York, brought back on square riggers returning from voyages to South America, Africa or India. In view of all this, it is hard to understand why it was not until July 21, 1791, that another Lion was advertised for exhibit in the city. This one could be viewed, "tractable and docile . . . at the house of Jacob Arden, 22 Gold Street, next door to Mr. Cornelius Roosevelt's china store."

Then, in 1796 a "beautiful African Lion" was to be seen "everyday except Sunday at the Ball-Alley in the Fields next to the corner of Murray Street, in Broadway." The Lion's enterprising proprietor enthusiastically advertised that "this noble animal is between three and four feet high, measures eight feet from nostril to tail, is a beautiful dun color, between 6 and 7 years old, and uncommon strong built. His legs and tail are as thick as those of a common sized ox. He was caught in the woods of Goree, in Africa, when a whelp. He is as tame as any domestic animal whatever." This kind of come-on is in marked contrast to the simple statement that the first Lion "will be there" at the Jamaica Fair. Competition was beginning to be an issue by this time.

The second known species of wild animal to be imported for viewing in New York was a Camel, whose arrival was heralded in the *New York Royal Gazette* on November 12, 1739:

"Notice is hereby given to all Persons, that there is come to Town, a very Wonderful and Surprizing Creature to all Persons in these Parts of the World; and it is in the Scripture the very same Creature which is there called a CAMMEL. It is impossible to describe the Creature; and therefore all Persons of ingenious curiosity have an opportunity of satisfying themselves.

"The Creature was brought with Difficulty from the Deserts of Arabia in that Quarter of the World which is called ASIA, to New England; a curiosity which never was in this Country, and very likely never will be again. Constant attendance will be given to all Persons desirous of seeing said Creature at the Sign of the Cart and Horse."

The proprietor of the Camel stressed the Biblical connection of his beast because he knew it was smart business to do so. In those days many



The King of the Vultures. | The Ourang Outang; or, Wild Woman of the woods. | The East-India Porcupine.

MUSEUM & WAX-WORK,

At the EXCHANGE, NEW-YORK,

The Public are informed that this AMERICAN MUSEUM contains an extensive Collection of the Productions of Nature and Art: Among which are the following

<p>NATURAL CURIOSITIES.</p> <p>1. A PERFECT Horn that grew out of a woman's head in this city, it is about five inches in length, and grew from behind the right ear.</p> <p>LIVING ANIMALS.</p> <p>2. A Porcupine from the East Indies, the only one ever seen in America: His quills are very long and formidable, and considered as a great curiosity.</p> <p>3. The Am Bear, from the coast of Patagonia, a beautiful animal, and the only one ever brought to this country.</p> <p>4. The American Grey Squirrel, in a machine, in which he grinds pepper for his living. With a number of other animals.</p> <p>LIVING BEASTS.</p> <p>5. A King of the Vultures, from South-America: This remarkable bird is about as large as a turkey, the head and neck is beautiful, and resembles the head of an Indian when painted and decorated in an elegant style.</p> <p>6. The American Eagle, very large and gay.</p> <p>PRESERVED ANIMALS.</p> <p>7. The male and female Ourang Outang, or, the man and woman of the woods, with a Foetus of the same, perfect in spirits, in a fine state of preservation, from Africa, the greatest natural curiosities in America.</p> <p>8. The American Buffalo, in his natural standing position, while alive.</p> <p>9. The Brazil Porcupine.</p> <p>10. The Armadillo, from Terra Del Fuego.</p> <p>11. Several American Alligators.</p> <p>12. Several Monkeys, of different species.</p> <p>13. The Sloth, from South-America, said to be the most docile of all animals.</p> <p>14. A Lamb, with two perfect heads and necks complete, and with but one body, from</p>	<p>20. The Pinguin, from Faulkland Islands.</p> <p>SNAKES.</p> <p>21. A large number of remarkable Snakes, among which are, the Yellow Snake, from South-America, 18 feet in length.</p> <p>22. The American Rattle and Hoop Snakes.</p> <p>23. The Glass Snake, from South-Carolina.</p> <p>FISH.</p> <p>24. A large number of Fish, and parts of Fish, among which are, the Sword, Saw, and Thrasher, which are formidable enemies to the Whale.</p> <p>25. The Dolphin, Flying Fish, Porcupine Fish, and Sea Horse.</p> <p>26. An uncommon large Jaws and Teeth of a Shark, with a knife, that was found in him when taken.</p> <p>27. Corals of various kinds, and a number of Fossils and Minerals.</p> <p>28. A beautiful collection of Shells, and other Marine productions.</p> <p>29. A large collection of beautiful Butterflies, and other Insects, from St. Croix, together with a large number of other curiosities, from the Universal Garden of Nature.</p> <p>ARTIFICIAL CURIOSITIES.</p> <p>30. A large collection of Mr. Bowen's celebrated Wax-Figures, (in full stature) among which are, the American Divine, the Philosopher, the Statesman, the Hero, the Venerable, the Artist, the Beautiful, and the Ugly.</p> <p>31. The celebrated Frontispiece M. Blanchard.</p> <p>32. Two beautiful Mandarins, from the East-Indies, dressed in the modern style of that country.</p> <p>33. A Transparent Monument (placed in the centre of the room) sacred to the Memory of Christopher Columbus, who discovered to Mankind this Western World, on the 12th of October, 1492.</p>	<p>34. Several Chinese Instruments of War, and other curiosities.</p> <p>35. An excellent Electrical Machine and Apparatus.</p> <p>36. An Air-Gun, made in this city by an American Artist. This Gun, when properly charged, will discharge about twenty bullets successively, without renewing the charge, for several times it will discharge a bullet to do execution at the distance of sixty yards.</p> <p>37. A collection of Coins and Medals.</p> <p>DESCRIPTION OF THE ROOM.</p> <p>THE Room in which the MUSEUM is contained, is 60 by 30 feet, with an arch of 20 feet high, on which is elegantly painted a sky blue, and intermixed with various kinds of clouds, in some of which are naturally represented a Thunder-Storm with flashes of Lightning. On the walls are elegantly painted, a large number of Trees, from various parts of the world; some of which are as large as their natural full growth; among which are the celebrated Bread Fruit Tree from the Pacific Ocean, and the delicious Mangosteen from the same country, &c. &c. These trees or plants are surrounded by smaller ones of the same kind, forming beautiful groves, which have a fine effect. Also, on the walls of the room are painted a number of beautiful Birds, from various parts of the world; among which are the Spoon-bill, the Bird of Paradise, the King of the Forest, together with a great variety of foreign Animals, among which are the Rhinoceros, Zebra, Hyena, Leopard, Hippopotamus or River Horse, Camel, Camelpard, Elephant, Lion, &c. &c.</p> <p>The above Paintings were copied from the best Historical Prints, and are universally allowed to be excellent imitations, with respect to color and form, the whole forming a most magnificent scene.</p>
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This broadside advertised New York's first museum, opened in 1791. Live animals were added to its "Menage" at Pearl Street and the Battery in 1794 and thus it was our first zoo.

Courtesy of The New-York Historical Society, New York City

people heartily disapproved of any activities that were merely for amusement, or for curiosity's sake. Such persons looked askance at animal exhibits, and considered them to be sinful and worldly pleasures. If viewing a Camel could in any way be regarded as a religious pastime, people could gawk to their heart's content without fear of incurring the wrath of God.

Of course plenty of people went to animal exhibits just to be amused. The same year that the Camel was shown, a trained horse was exhibited — the first advertised trained animal act in the city.

"Soon will come to Town the up right German Hans who understand several languages, the most ingenious Horse that ever was seen in this country. He salutes the spectators . . . if he is ask'd a Question

he answers affirmatively with a Nod, and negatively by shacking of his head; if you show him a Pack of Cards, for every King he makes three Compliments, for the Queens two, for the Knaves none, and counts the Pips of the other cards by striking with his Foot against a Partition; he understands Arithmetick; he feigns himself a Coward if you talk to him of War, by following of his Master as tho' he was Lane; . . . he drinks a Cup of Wine, knows how to distinguish between the good and the bad, and to tell Prices etc. He is to be seen at"

Unfortunately, part of the last sentence is missing, and the location of this extraordinary horse remains a historical mystery.

The next recorded animal exhibit in New York was a monkey, a glowing ad for which appeared in the *New York Post-Boy* on February 25, 1751:

"To be seen at the house of Mr. Edward Willet at White-hall, a creature, called, a JAPANESE, of about 2 feet high, his body resembling a human Body in all parts except the feet and tail: He walks upright, and performs various actions to admiration; such as walking upon a line, hanging and swinging under it, exercising the Firelock, dances to any tune, and sundry other things too tedious to mention. The Sense and Agility of this Creature, renders him worthy the observation of the curious. Attendance is given at said Place every Day in the Week (Lord's Day excepted) from 2 o'clock in the afternoon 'till nine at Night. One shilling."

This talented primate was probably an Indian Rhesus Monkey, as India was the usual destination of American ships to Asia in those days. It was not until a number of years later that American ships did any regular trading with China, Japan or the East Indies.

A four-foot-long Alligator was to be seen in July, 1754, and a Buffalo, captured near the Mississippi River, was shown to the public in December, 1757. Buffalo were evidently already quite scarce in most areas east of the Mississippi, although the last wild Buffalo in Pennsylvania were not killed until more than forty years later.

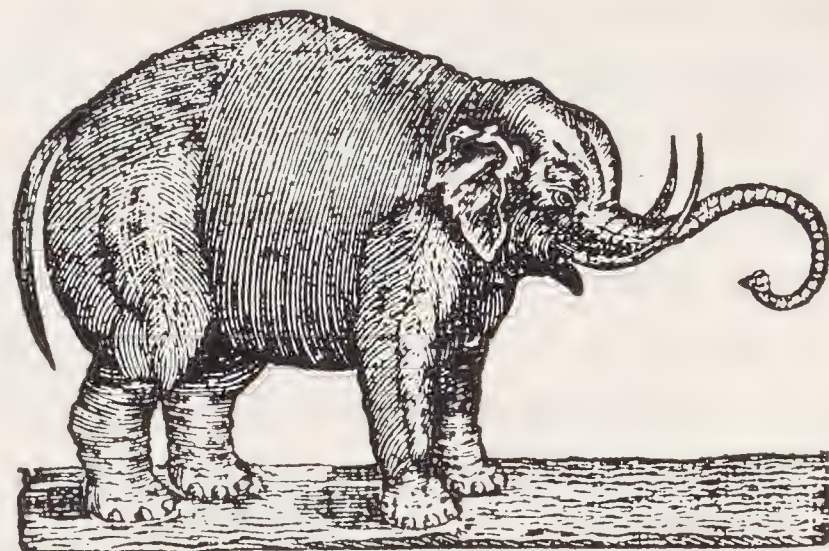
Freaks and monstrosities were sure-fire attention-getters and crowd-pullers in those early days, just as they are today. In February, 1761, the following eye-opening announcement appeared in the *New York Mercury*:

"A surprising Monster was caught in the Woods of Canada near the . . . St. Lawrence, and has with great difficulty been tamed, and brought to the House of James Elliot, at Curler's Hook . . . The Monster is larger than an Elephant, of very uncommon Shape, having three heads, eight legs (*Pudentia* now forces deletion) It is of various Colours, very beautiful, and makes a noise like the Conjunction of two or three voices. It is held unlawful to kill it, and is said to live to a great age. The Canadians

could not give it a Name, 'till a very old Indian Sachem said, He remembered to have seen one when he was a Boy, and his Father called it a GORMAGUNT."

Everyone has always loved a mystery, and just what this weird object was, is anybody's guess. What is most interesting about the Gormagunt is that it is the sort of thing that Phineas T. Barnum, the greatest showman of them all, dearly loved, and upon which his fame was founded. Yet the notice for the Gormagunt antedates Barnum and his philosophy that "There's a sucker born every minute" by more than a century. Apparently there has always been a Barnum.

Nearly anything was anti-climatic after the Gormagunt, but those who were content to see more authentic live animal exhibits were able to see a Leopard, "well secured with a chain," on exhibit in 1768 on Broadway near St. Paul's



THE Elephant,

ACCORDING to the account of the celebrated BUFFON, is the most respectable Animal in the world. In size he surpasses all other terrestrial creatures, and by his intelligence, he makes as near an approach to man, as matter can approach spirit. A sufficient proof that there is not too much said of the knowledge of this animal is, that the Proprietor having been absent for ten weeks, the moment he arrived at the door of his apartment, and spoke to the keeper, the animal's knowledge was beyond any doubt confirmed by the cries he uttered forth, till his Friend came within reach of his trunk, with which he caressed him, to the astonishment of all those who saw him. This most curious and surprising animal is just arrived in this town, from Philadelphia, where he will stay but a few weeks. He is only four years old, and weighs about 3000 weight, but will not have come to his full growth till he shall be between 30 and 40 years old. He measures from the end of his trunk to the tip of his tail 15 feet 8 inches, round the body 10 feet 6 inches, round his head 7 feet 2 inches, round his leg, above the knee, 3 feet 3 inches, round his ankle 2 feet 2 inches. He eats 130 weight a day, and drinks all kinds of spiritous liquors; some days he has drank 30 bottles of porter, drawing the corks with his trunk. He is so tame that he travels loose, and has never attempted to hurt any one. He appeared on the stage, at the New Theatre in Philadelphia, to the great satisfaction of a respectable audience.

A respectable and convenient place is fitted up at Mr. VALENTINE's, head of the Market, for the reception of those ladies and gentlemen who may be pleased to view the greatest natural curiosity ever presented to the curious, and is to be seen from sun-rise, 'till sun-down, every Day in the Week, Sundays excepted.

The Elephant having destroyed many papers of consequence, it is recommended to visitors not to come near him with such papers.

Admittance, ONE QUARTER OF A DOLLAR.—CHILDREN, NINE PENCE.

Boston, August 18th, 1797.

BOSTON: Printed by D. BOWEN, at the COLUMBIAN MUSEUM Precis, head of the Mall.

Elephants were more valuable in 1796 than they are today. This one, the first seen in America, came to New York from Calcutta, sold for \$10,000, and was widely exhibited.

Courtesy of Peabody Museum



Church. A year later “a beautiful animal called a TIGER” was to be viewed for six pence at the house of Mr. Abraham De La Montanye in the King’s Arms Tavern.

The next ten years were even more sparse for lovers of animal exhibits. Part of the trouble stemmed from the unrest and disorder among the colonies because of their increasing difficulties with England. When the trouble was coming to a head, in 1774, the Continental Congress passed an act which forbade any amusement performances. Then came Lexington, and the shot heard ’round the world. The British occupied New York during most of the Revolution, and the citizens were too concerned with more serious matters to want to attend animal exhibits.

In the fall of 1781 Cornwallis surrendered to George Washington at Yorktown, and the weary years of war were finished at last. In the next two decades animal exhibits and acts flourished and expanded in New York as never before.

Trained animal acts became much more common. Such run-of-the-mill items as performing dogs and horses were prevalent, but more unusual trained birds and pigs were also featured. In 1790, one self-styled bird artist, from Augsburg, Germany, advertised that he and his troupe of birds had performed before the Emperor of Germany, His Majesty Lewis XVI, and

The lower end of Manhattan in 1794. Facing the Battery (at the right of the flagstaff) was the Leopard exhibit; the first elephant was shown back of Government House (center).

Courtesy of The New-York Historical Society, New York City

that his proteges could do many wondrous tricks. One canary, for example, was to be seen dressed as a sentry, wearing a grenadier’s cap and carrying a gun in its claws.

Not to be outdone, the proprietor of a “Learned Pig” proclaimed that even though “the stupidity and stubbornness of the PIG is proverbial,” his intelligent pet was trained so that it “reads print or writing, spells, tells the time of day . . . by any person’s watch in company, the date of the year . . . distinguishes colours, how many people present, Ladies or Gentlemen . . . will exercise his talents in arithmetic,” and numerous other remarkable feats. This enthusiastic spiel could well be regarded as a forerunner of that offered by the modern circus barker.

Equestrian shows, featuring fancy horsemanship and acrobatics, were becoming very popular with the general public, and during these last decades of the eighteenth century New York was seldom without at least one such show. A generation later this type of entertainment combined with the traveling menageries to form the typically American circus.

During this same post-Revolutionary period New Yorkers saw their first menageries, too. They were meagre showings compared to the New York zoos of today, but still they were the beginnings. The first known menagerie was located at 20 Great George Street, and was advertised for the first time on December 19, 1781. It was open to visitors from nine in the morning to nine at night, and featured "an exhibition of the most beautiful, curious, and extraordinary productions of nature ever before exposed to view in America . . . consisting of birds, reptiles, snakes, and quadrupeds."

Though this proudly presented collection is of special interest historically as the first of its kind, the description of it is so vague that we do not even know if most of the animals were alive or stuffed. The anonymous owner must not have been making much money in any case, for he offered for sale this "superb collection (the laborious researches of many years) at very moderate terms."

In 1789 another collection, from Africa and Brazil, hopefully opened its doors to the public. It featured a "male and female Ourang Outang 'Man of the Woods,' a sloth with sluggish disposition, baboon, monkey, porcupine, ant bear, crocodile, lizard, sword fish, snakes, Tame Tiger and Buffalo, and variety of birds." All these, including the African "Ourang Outangs" which were undoubtedly Chimpanzees, could be seen at 28 Wall Street for five shillings.

It was not until 1794, however, that the first menagerie of any permanence was started in New York. This one was started by Gardiner Baker, the colorful keeper of Tammany's American Museum, which was the first natural history museum in New York, and the second in America. It is hard to imagine that Tammany as we know it today might in any way have been connected with a museum or zoo, but in those days the organization was exclusively cultural. Baker had at first kept a few live animals in the museum, but when the quarters there became too cramped, he established the separate menagerie. It was located on the corner of Pearl Street at the Battery — a very advantageous spot. He enclosed the lot with a "neat fence" and built a number of enclosures. He explained proudly in his advertisements that "the animals could be visited with

the greatest safety, as they are all confined in Koops or cages."

Baker was a remarkable man — a resourceful showman and a worthy forerunner of the later, more famous Barnum. He constantly ran titillating ads for his "Menage" and energetically increased his collection at every opportunity. In 1797 he proudly displayed to the interested spectator, for an entrance fee of one shilling, an exhibit that included Wolves, Bears, Opossums, Groundhogs, a Bald Eagle, "moccoco, noble species of Monkey, very large and a small one of a different species, the Mongooz . . . wild hog, of the forests of South America — a very curious animal; it is said that the navle is on the back . . ." The advertisement for this diverse collection ended on a somewhat lugubrious note: "Those who wish to gratify themselves with the sight of these remarkable productions of nature had better make early application, for it is not uncommon for those that are foreign to live but a short time." Mr. Baker did not hesitate to capitalize on the delicacy of his charges. Unfortunately it was Baker himself who lived but a short time, and his well-established menagerie went out of existence after his death in 1799.

In spite of the growing interest in and appreciation of animal exhibits, the cruel sport of animal baiting continued to have its devotees. On April 19, 1797, a bear-baiting was held near "Bunker's Hill, which terminated unfavorably to the sporters; for the bear got loose, and hugged, most fraternally, some of the spectators."

Exhibits of individual animals by transient showmen became quite common. Most of these were displayed at taverns or coffee houses where the exhibitors figured that they were most likely to find crowds already gathered and in a jovial mood that might incline them to pay the necessary admittance fee. In 1782 a Panther was "to be seen at the Old Punch House, next to the Tea Water Pump." Five years later two Camels were exhibited at the stables of Mr. Stephen, adjoining the snuff and tobacco manufactory of William Maxwell on Wall Street. Their owner loudly trumpeted that "The form of these animals is so remarkably curious, and their natural powers (of which the spectators will be informed at the above mentioned place) and their sagacity are so extraordinary that it is presumed all persons hav-

ing a desire of seeing them will be pleased to have their curiosity gratified at the small expense of one shilling." In 1790, Buffalo and Panther were again featured. A male Moose turned up in 1796, and a Cassowary "nine feet high" was to be seen three years later.

Probably the most important single animal to be seen in New York during the eighteenth century was the first Elephant ever to be brought to America. This was a two-year-old female Indian Elephant, purchased for \$450 in Calcutta by a Salem, Massachusetts, ship captain, Jacob Crowninshield, and landed in New York on April 14, 1796. The sea captain, who proved also to be a wily Yankee trader, sold this historic animal for a neat profit, as recounted in the *New York Argus* for April 18:

"The *America* has brought home an Elephant, from Bengal, in perfect health. It is the first ever seen in America, and is a very great curiosity. It is a female, two years old, and of the species that grows to an

enormous size. This animal is sold for Ten Thousand Dollars, being supposed to be the greatest price ever given for an animal in Europe or America."

This famous beast remained in New York, and was exhibited on the corner of Broadway and Beaver Street for several months before being taken on tour. In the next several years it traveled through a great part of the young United States, from Massachusetts to Georgia, and entertained countless thousands of curious citizens with its antics.

As the eighteenth century drew to a close, the citizens of New York were showing an increasing awareness of animals and an ever livelier interest in them. Animal exhibits were fast becoming a regular feature of entertainment in the rapidly growing city. These early exhibits are of particular interest because they were the *first* exhibits of the kind. As such they modestly pointed the way to the greater wonders yet to come.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

More Tiger Cubs—Nos. 28 & 29— and We've Run Out of Names

Dacca, the Zoological Park's prolific Tiger mother, produced her ninth litter of cubs on May 3. Two were born, both males, and thus the total of Dacca's progeny reaches 29 since 1948.

It had been hoped that at least one of the new cubs would be a female, to provide future breeding stock, but Dacca has run consistently to males in her last four litters. Her production record is:

Litter	Males	Females	Date of Birth
1	2	2	May 4, 1948
2	1	2	May 6, 1949
3	2	1	May 18, 1950
4	—	4	May 10, 1951
5	2	2	May 1, 1952
6	3	—	May 24, 1953
7	4	—	May 7, 1954
8	2	—	June 3, 1956
9	2	—	May 3, 1957
	18	11	

With her present cubs, Dacca is being her usual solicitous self and so they will be allowed

to stay with her. They are among the largest and strongest of her offspring, weighing 3 pounds and 3 pounds 7 ounces respectively. Although Tiger cubs normally stay with their mother in the sleeping den in the Lion House for five or six weeks before gaining enough strength to climb over the 12-inch side of their box and crawl outside, the present cubs managed to make a short excursion into the open within a few days of birth.

Mrs. Helen Martini, who hand-reared Dacca and her two brothers at the time of their own birth in 1944, has always had the privilege of naming Dacca's cubs. She has now, with No. 28 and 29, reached the limit of her inventiveness, and has turned the task over to the Mammal Department. Any suggestions of appropriate names would be welcomed. — W. BR.

"Zoo Trains" Again

Saturday trains from the New England area to the Bronx Zoo are again being operated by the New Haven Railroad, starting at the end of April and continuing to the middle of June.



It took a little more than half an hour for Bilota (left) and Muyoni (right) to make friends in Okapi fashion after they were allowed to run together for the first time on Friday, May 10.

Okapis Together for First Time and All Is Well—So Far

When Muyoni, our female Okapi, arrived from the Belgian Congo last November after a total of 90 days in quarantine, she was so heavily infested with intestinal parasites and so anemic that it was seriously doubted whether she would survive. Although we were anxious to introduce her to Bilota, our hale and healthy male Okapi, it was out of the question to put them together and risk transfer of the infection.

As a result of intensive medication during the winter, Muyoni's condition has improved to such a degree that it is now safe to make her acquainted with her prospective mate. They were turned into the same corral for the first time on May 10 and their behavior is highly favorable.

For the first half an hour Muyoni's attitude alternated between indifference and mild annoyance. A few times she made half-hearted kicks in Bilota's direction when he strolled too close, and once she butted him vigorously with her head. Her petulance then subsided and she allowed Bilota to lick her ears. The two animals

now seem completely adjusted to each other.

There are two other pairs of Okapis in the United States — in the National Zoological Park in Washington and the Brookfield Zoo in Chicago. The National Zoo has managed to keep its male and female together, after some initial disturbances, but in mid-May the Chicago pair had not been put together. There will now be, inevitably, a race among the three zoological parks to see which will be the first to breed — and rear — a young Okapi. — W. BR.

Head Keeper Scott Supervising Whooping Crane Nesting

By agreement with the Federal Fish and Wildlife Service and the Audubon Park Zoo in New Orleans, Head Keeper of Birds George Scott has been given the job of supervising the rearing of young Whooping Cranes after the hatching of two eggs laid by the pair in Audubon Park. He left New York on May 7 and will stay with the birds until the eggs hatch and the young are well along some two months hence.

The Whooping Crane is close to extinction;

23 birds are known in the wild, plus three in captivity. Last year and the year before, the Audubon Park pair laid eggs and hatched young, but the young cranes died or disappeared shortly thereafter. It will be Mr. Scott's job to see that the youngsters get a good start in life. — W. BR.



Annie, the male Black-footed Penguin who is the sole identifiable survivor of the penguin colony from the old Aquarium at the Battery, will have the honor of snapping at a fish and breaking a ribbon to open the new Stage One building on June 5. Annie, standing at the entrance of a nesting cavity in the Zoological Park, has had some nesting ambitions lately, but not strong enough to interfere with his duty as the official opener-of-the-Aquarium.

PUBLICATIONS OF INTEREST

THE BIRD BIOGRAPHIES OF JOHN JAMES AUDUBON. Selected and edited by Alice Ford. 282 pp., illus. twelve color plates of drawings by Audubon. The Macmillan Co., New York, 1957. \$10.00.

Issued as a text for Audubon's monumental "The Birds of America," the Ornithological Biography consists of a series of accounts of the habits of birds and the author's personal experiences with them. First published from 1831 to 1839 and reissued at later dates, they are rich in early Americana as well as attesting the keen observational powers of the great delineator of birds. Eighty of these biographies have been selected and edited by Miss Ford, thus making them readily available to readers who do not have access to the great libraries which possess the original volumes.

The twelve colored plates are from previously unreproduced Audubon originals owned by the Harvard



Herding the Flamingo collection into the Aquatic Bird House on cool spring evenings has always been a difficult chore, requiring half a dozen keepers waving poles. Curator Conway has now gotten the birds accustomed to one keeper, who steps over the fence and blows a whistle. The birds thereupon turn and file in for the night, promptly and orderly.

University Library. Without opportunity to check them against the drawings, the accuracy of the color printing cannot be appraised but the Carolina Parakeet opposite page 172 certainly appears much too blue. Printing, binding and make-up are of a high order, so that this book will make a handsome and useful addition to the nature library. — L. S. C.

NO ROOM FOR WILD ANIMALS. By Bernard Grzimek. 271 pp., 3 maps, 20 illus. W. W. Norton & Co., New York, 1957. \$3.95.

Dr. Grzimek is Director of the Frankfurt Zoo, well and favorably known to other zoo men. This is his account of a trip to the Belgian Congo to get animals for his zoo, but it is far more than that: a reasoned plea for more living room for wild animals, shrewd observations on native peoples, sharp comments on hunting and the administration of game laws, a loving account of encounters with animals. Not heavy, but sound and absorbing.

FLEAS, FLUKES AND CUCKOOS. By Miriam Rothschild and Theresa Clay. The New Naturalist Series. 305 pp., 99 photographs, 4 maps, 22 drawings. The Macmillan Company, New York, 1957. \$5.00.

Collaboration between the world's greatest authorities on bird-fleas and bird-lice produced this study but it would be a mistake to consider it merely another weighty tome for the specialist. It is a study of bird parasites broadened to include not only parasitism but commensalism and symbiosis. It will not surprise anyone familiar with the New Naturalist Series that it is well-written, well printed and actually enjoyable by the non-specialist.

BUTTERFLIES. By E. B. Ford. The New Naturalist Series. 368 pp., 87 photographs in color, 89 in black-and-white, 41 maps and diagrams. 3rd edition. Collins, London, 1957. \$6.00.

Interest in identifying and collecting butterflies is more general in England than in this country, and Dr. Ford's book grows out of and surely has stimulated that enthusiasm. It discusses and illustrates life-size, in color, every known British butterfly and if that limits its usefulness to American readers, they have only to turn to the chapters in the biology of butterflies to have their own interest revived.

PAUL MANSHIP. By Edwin Murtha. Foreword by David E. Finley. More than 220 photographs of sculpture and 8 reproductions of drawings. Biographical chronology, bibliography, catalogue of the sculpture, index of places. The MacMillan Company, New York, 1957. \$12.50.

For forty years Paul Manship has held a place of honor in the art of sculpture in America. Early in his career his work showed a decorative style that differed from that of his contemporaries. Influenced by East Indian, Greek, Roman and Renaissance art, he yet maintained an individual and imaginative conception of his own and he, in turn, influenced many of the younger sculptors in America.

Of special interest to members of the New York Zoological Society is his beautiful Paul J. Rainey Memorial Gateway at the main entrance to the Bronx Zoo. Of this masterpiece Mr. Murtha comments: "The greatest

imaginative and technical problem that Manship has met in his career . . . the Bronx Zoo Gates are an example of Manship's decorative genius on an imposing scale."

"Paul Manship" is a handsomely designed and beautifully produced book and the many illustrations give a comprehensive and exciting survey of the varied aspects of Manship's work. — H. D. T-V.

VASTNESS OF THE SEA. By Bernard Gorsky. Pp. 305. Illustrations, two maps, no index. Little, Brown & Co., Boston, 1957. \$5.00.

An account of four young Frenchmen on the first half of a trip around the world in a small sloop with the sole object of submarine diving and spear-fishing. It is thus the latest of a long list of books with the emphasis placed on mantas, barracudas, moray eels and sharks. It has the great advantage over the others in not claiming to be scientific. Indeed, it even mentions a sea-urchin which shoots its spines! As an adventure story it makes pleasant reading. Incidentally the accounts of the various ports of call, Tangiers, the Canaries, Martinique, Galapagos, the Marquesas and Tahiti form an adequate foil to the never-ending search for and harpooning of vast numbers of various fishes. Especially interesting is the description of the Hermits of the Galapagos Islands. — W. BEEBE.

New Members of the New York Zoological Society

(Between March 1 and April 30, 1957)

Fellow

Dean Amadon

Life

Jules R. Breuchaud
Peter Gimbel

Contributing

Charles Allen, Jr.
Mrs. Ethan Allen
Mrs. George I. Appel
Dr. Elisha Atkins
Mrs. George K. Bennett
Mrs. William O. Bloom
B. Rionda Braga
Mrs. L. R. Breslin, Jr.
Mrs. Ludlow Bull
John D. Butt
Frank Cioffi
Edward Gelsthorpe
Mrs. Donn Golden
Arthur W. Hansen
Dr. Amanda Hoff
Mrs. Frederick E. Lowell
Paul Cushman McGee
Oliver M. B. Milton
Mrs. Richardson Pratt
Mrs. Edwin Schlesinger
Mrs. Boris Sergievsky
Arthur B. Singer
Miss Myrtle A. Sperber

Charles L. Weinberg
Lucius Wilmerding, Jr.

Annual

J. B. Adams
Mrs. Daniel S. Ahearn
John Alsop
Joseph R. Armstrong
James K. Berman
Robert C. Burtnett
James Francis Busardo
Nino J. Catalano
Blair Coursen
Mrs. W. Perry Curtiss, Jr.
Mrs. Girard de Piolenc
Mrs. Richard Derby
Sidney A. Diamond
George M. Duff, Jr.
Leonard J. Essman
Mrs. William Rodman Fay
Herbert E. Fleischer
Miss Rosalie Fleissig
Henry W. Ford
Mrs. Edith T. Franken
Mrs. Ulrich J. Franzen
H. W. Freed
Eliot Freidson
Kenneth W. Greenawalt
Walter Hahr
Dr. Jacob R. Handelsman
Miss Sally Hoffman
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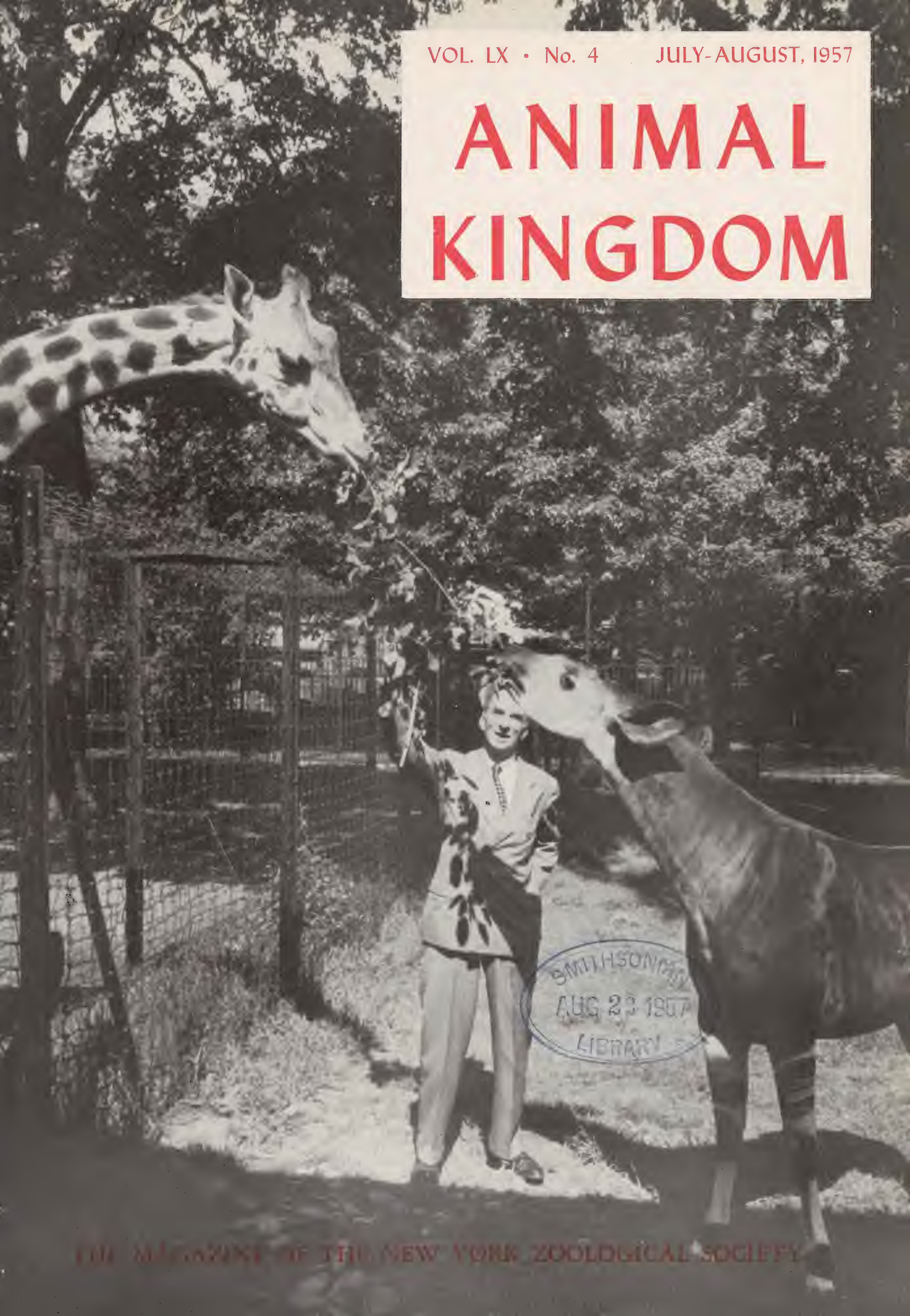
In case you *will* be near at hand on June 15, don't forget that's the day Dr. James A. Oliver, Curator of Reptiles, will lead a Members' Tour through the Zoo starting at 11:00 a.m. It's the third and last Members' Tour this season—and you'll want to be there if you can.



VOL. LX • No. 4

JULY-AUGUST, 1957

ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LX AUGUST 1957 No. 4

Issued bi-monthly at the Offices of
the New York Zoological Society,
30 East Fortieth Street, New York
16, N. Y. Editorial and Subscrip-
tion Offices, Zoological Park,
Bronx Park, New York 60, N. Y.
Title registered with United States
Patent Office • Subscription,
\$3.50 a year; single copy, 60 cents.
Same rates for all foreign coun-
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Poison from the Sky

A COUPLE OF MONTHS AGO a widespread program of intensive spraying of D.D.T. from airplanes was carried out in several of the northeastern States. This program was under the auspices of the U. S. Department of Agriculture with the purpose of controlling the spreading of the Gypsy Moth, a recognized blight to forests. As it turned out, the consequences of the program upon wildlife were alarming to a degree. It resulted in the destruction of untold numbers of birds, of fishes in many lakes and ponds, and of other forms of animal life. Public indignation justifiably occurred in many affected communities.

Our institution is much perturbed about this situation, and, together with The Conservation Foundation, has already initiated a research program to gather together all available facts. We want to determine whether pesticide spraying from airplanes is actually justified, or, to express it differently, whether the benefits that may result from it are not outweighed by the harm it does. It is a complex problem, yet the first responsibility of our Society is to oppose unthinking destruction of wildlife.

The ever-increasing intrusion of man upon nature represents a striking phenomenon of the modern age. Unfortunately, some of this is unavoidable due to the continuing growth of urban and industrial centers and the demands for living space for steadily increasing populations not only in our country but throughout the world. Certainly the pressures upon wildlife should not be made even more severe by a program such as airplane spraying unless all the consequences are fully understood and measured.

Fairfield Osborn

COVER NOTE

EARLIER THIS SUMMER several professional photographers tried in vain to make just such a photograph as appears on the cover of ANIMAL KINGDOM — a Giraffe bending down towards its only living zoological relative, the Okapi. Nothing would induce the two animals to move close enough to appear on the same negative. A few weeks later President Osborn was asked by a national magazine to allow himself to be photographed with an animal or two. Not knowing that the thing was impossible, he went down to the Antelope House, held up a branch, and the Giraffe and the Okapi obligingly moved into position. For him they did it.

AUG 15 1957

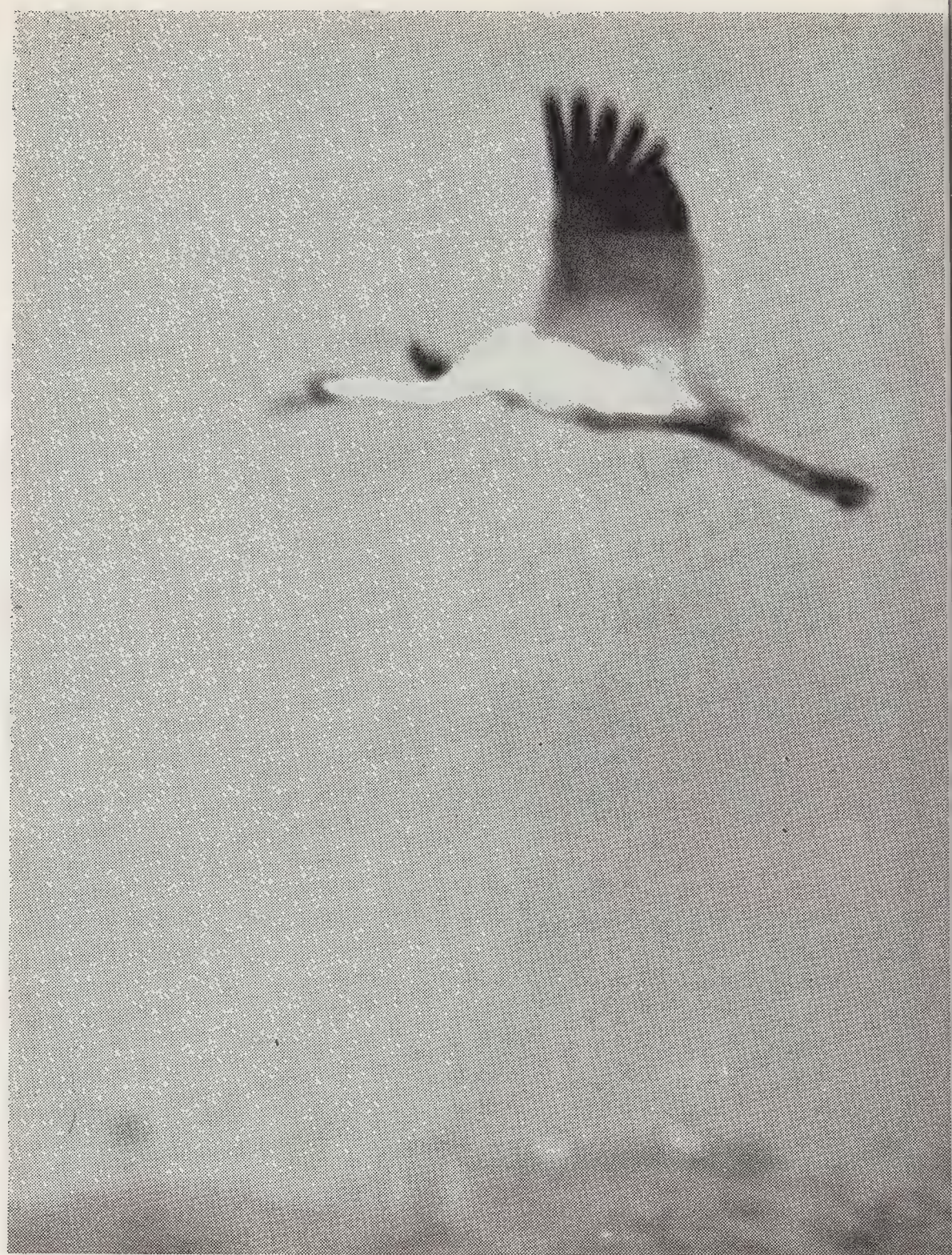
Three Days with a Family of Whooping Cranes

By William G. Conway

FOR THREE DAYS at the end of May I shared with George Scott, the Bronx Zoo's Head Keeper of Birds, a round-the-clock watch over two Whooping Crane chicks in the Audubon Park Zoo in New Orleans. Three days are not long, but even three hours with Whooping Crane chicks would make a red-letter day for any ornithologist, considering how little has been recorded about the breeding, nesting and rearing behavior of this rarest of all cranes.

The notes that follow are a summary of what I learned by observation and by asking questions.

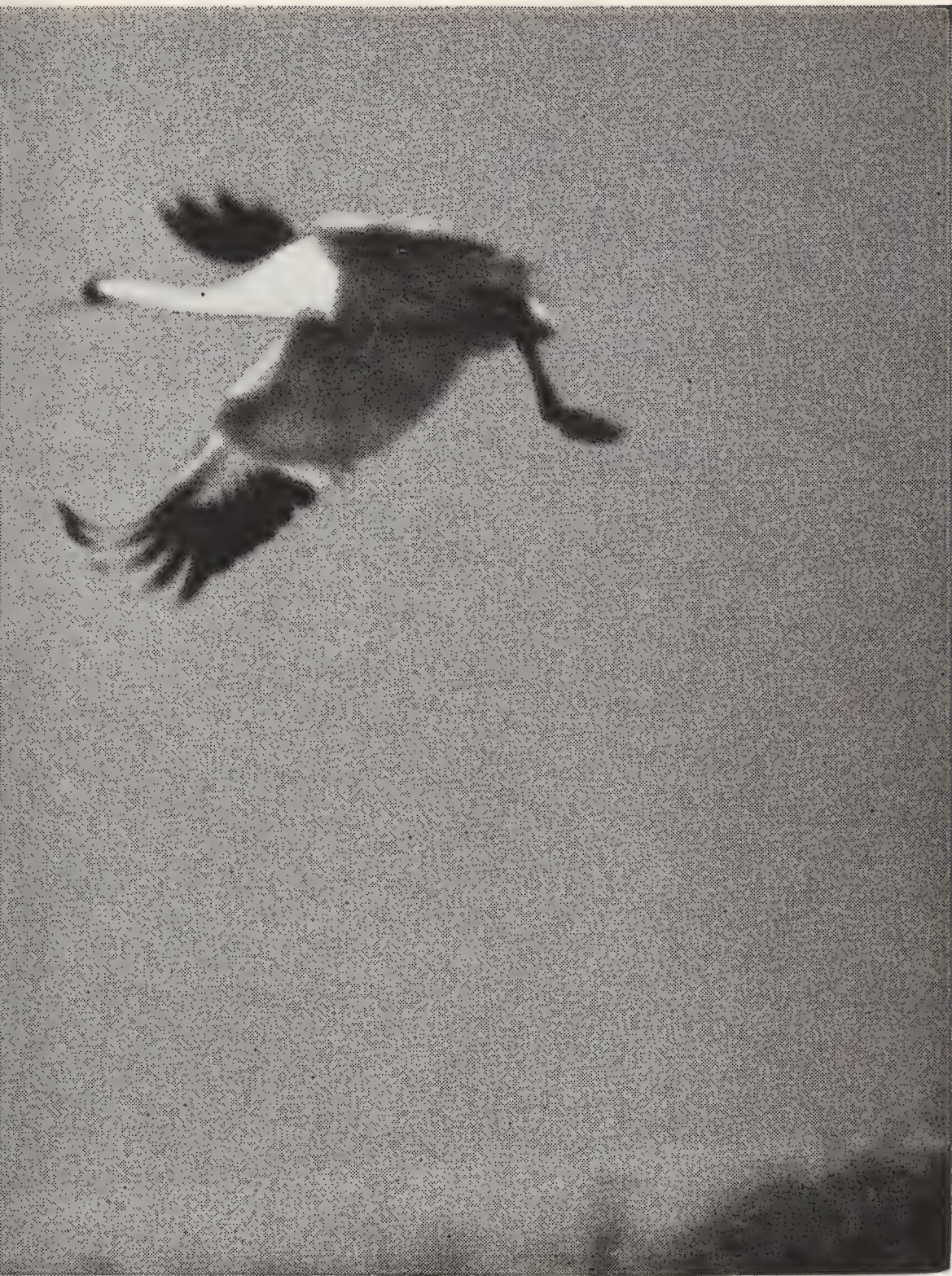
As the newspapers and magazines, radio and television have made America aware, only 23 adult Whooping Cranes are known to be still in existence in the wild. Three more are in captivity: a pair in the Audubon Park Zoo and a single, believed to be a female, in the San



Antonio Zoo. How many chicks resulted from the 1957 breeding season of the wild population is not yet known, but the whole country has been informed that "Crip" and "Josephine," the New Orleans pair, produced two eggs in May and that the eggs hatched.

Hatching is not rearing, unfortunately. In 1955 Josephine laid an egg on May 29, but a television technician teased the incubating bird through the fence and when she sprang to her feet in defence the egg was smashed. In 1956 eggs were laid on April 28 and May 2 and they hatched on May 29 and June 1. The second chick seemed weak and disappeared in a few days; the first and stronger youngster lived for 46 days and died of the fungus disease aspergillosis on July 13.

Well aware of the importance of increasing the



small and dwindling stock of Whoopers, the energetic Commissioner of Audubon Park, George Douglass, provided a spacious and secluded paddock for the birds and maintained a uniformed guard over them. Josephine laid one egg on April 18 of this year and another on April 21 to complete the normal crane clutch of two. As insurance against at least preventable accidents, it was agreed that Mr. Scott should be official collaborator for the Fish & Wildlife Service and Mr. Douglass entrusted him with direct care of the young cranes as soon as they should hatch.

Only 23 Whooping Cranes are known to exist in the wild and they are strictly protected — but subject to natural hazards of many kinds. These two were photographed in Saskatchewan last fall.

Photo by F. W. Labrman

In the Whooping Crane paddock in Audubon Park in New Orleans, one of this year's pair of captive-hatched youngsters nestles snugly in a "feather bed" on the back of its mother, Josephine.



Mr. Scott arrived in New Orleans on May 11, a week before the hatching of the first chick on May 18. The second hatched on May 21 and was four days old when I arrived for a brief visit to chronicle and advise.

I suppose one of the first things I noticed was the steadiness of the parent birds. Crip and Josephine paid absolutely no attention to observers talking and moving only a few feet away. Captives with such marvelous confidence may be excellent sources of information on the intimacies of the wild population.

The nest was placed precisely where it had been in 1956 and was merely a small, flattened pad of hay a little more than 14 inches in diameter. It was placed in one of the most open and unprotected areas of the enclosure. I was told that it was formed by Josephine lying down on the site and drawing the nest material to and under her with her long beak. Crip was never seen to offer her nest material, but he frequently pulled sticks about in the typical graceful building fashion of other cranes.

Both Crip and Jo took turns incubating the eggs, relieving each other at frequent intervals during the day. Josephine had the heavy duty; Crip did much of his incubation at night, when it was cool and breezy, leaving Josephine to struggle through most of the day's heat. Completely unshaded, in the direct semi-tropical sun, both birds panted with half-closed eyes during their day shifts. Unquestionably, their reflective white plumage helped them through the ordeal.

During a normal nest relief, the female might arise, reach down, delicately roll the two eggs with her bill and look about. At this point she was usually joined by Crip. As Jo walked away to preen, feed, or drink, Crip would take a position over the eggs, peer down, roll them anew, arrange them a slight distance apart, and gingerly settle down to his shift. Usually the eggs were incubated high-up, on either side of the breast. Crip was much less adept than Jo and required many adjustments and attempts to get settled in a satisfactory position. In most of his leg movements he appears slightly stiff. After he had incubated for awhile, he would stand up, carefully turn the eggs, and Josephine would appear to assume her shift, once again rolling the eggs. This meant, of course, that the eggs were

turned at least twice, before setting and upon leaving, by each bird at every shift of incubation duty. This rolling process is extremely important to the proper development of most bird embryos. Insufficient turning results in lowered hatchability and various chick deformities.

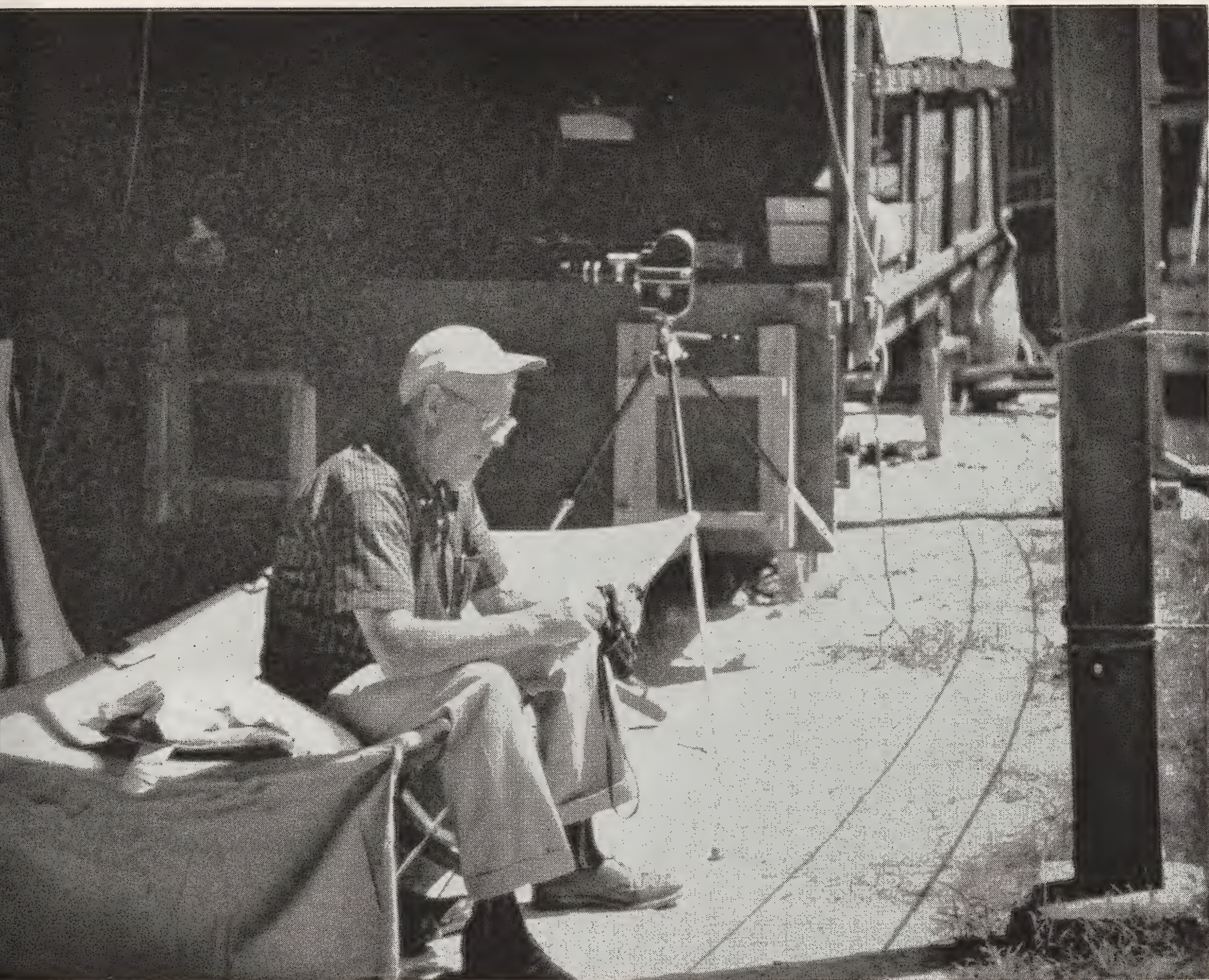
Mr. Scott related an incident which allows us to ponder the possible complexities of Whooping Crane family life. On one especially hot, steamy day Josephine incubated, gasping in the direct noon sun. Nearby, in the shade of a tall bush, Crip preened in comfort. Finally Josephine arose, made her usual preparations for leaving the nest, and looked about. Crip managed to avoid noticing this cue to take over at the torrid nest, turned his back and stalked away. It is difficult to interpret this action in other than human terminology, so we will merely report that Josephine finally hurried over to the water pail, took a long drink, and hurried back to the eggs.

No formalized nest exchange behavior was observed, such as we see in many birds, the relief mate merely keeping alert to take a shift at the nest when needed. The eggs were rarely left uncovered for any length of time. Surprisingly there was no special direction which the incubating birds faced at the nest and the egg orientation was often changed.

From 7:00 a.m. to 4:00 p.m., the day before the first egg hatched, the incubating parents changed shifts 21 times. Apparently abnormal, this shift schedule may have been caused by the terrific heat.

At 9:25 a.m., on May 18, Mr. Douglass reported the pipping of the first egg. By 10:40 a.m. a small hole was apparent at one side of the thick end of the egg. It was extremely hot; Josephine had been sitting all morning. 12:05 p.m., Crip relieved Josephine at the nest for two minutes. Both birds rolled the eggs as usual, despite the pipping. The hole did appear to end uppermost, however. At 2:30 p.m., Josephine rose and turned the eggs again. Crip made three awkward attempts to settle on the eggs, but Jo finally drove him away, again sitting on the nest herself. The hole was much larger and the chick could be seen moving within the egg. Mr. Scott reported the chick completely free of the shell at 11:30 p.m.

Questioning of Scott and Douglass revealed the following train of events. At 6:40 a.m., May



George Scott, the Bronx Zoo's Head Keeper of Birds, has been living alongside the Whooping Crane family night and day since May 11, just a week before the hatching of the first chick.

19, Crip came over and coaxed the chick from the nest while Josephine continued incubating the remaining egg. Seven hours and ten minutes from the time it was first seen free of the shell, the young one took its first steps outside of the actual nest. It did not, however, wander more than a foot or two from the site. The chick stayed out, unbrooded, the first time, for twenty minutes.

After incubating the second egg and brooding the chick for another hour, Josephine rose, turned the egg, and was relieved at the nest by Crip. The chick followed Josephine about for two and a half hours before being brooded when Josephine took over nest duty again. After a short time the chick attempted to leave the brood-

ing hen, but Jo nudged it back with her bill.

Altogether, it had taken the first chick from thirteen to fourteen hours to hatch after pipping. On May 21, 25 long hours and 30 tense minutes after pipping, the second chick hatched. Like the first, the second chick dried rapidly following hatching and left the nest, completely dry, within an hour of the time it was observed to be free of the shell. The shells were pushed to one side by Josephine, who had been incubating each egg when it hatched. The second chick ranged more than six feet from the nest on its very first excursion and seemed more vigorous than the first had been, even though its hatching period had been a prolonged one.

When I arrived in New Orleans, four days after the second hatching, the oldest chick stood nearly seven inches tall. Covered except for their pale orange, brown-tipped bills and sturdy legs with soft down, the baby cranes very much re-



sembled over-sized barnyard chicks. Face and forehead were yellowish-brown and their color graded to a darker, rusty, buffy brown on back and thighs. Breast and belly and a prominent spot on each humerus were a soft grayish-white washed with buffy ochraceous. The heavy legs were encased with down to the tibia, where the bare gray scales contrasted with the dark brown of the tarsus set off by a pale orange tarsal joint and foot. In contrast to the adults' yellow eyes, the eyes of the young were warm dark brown.

Thirty hours after hatching, shortly before 6 a.m. on May 20, the first chick took its first food. Comparatively precocious, chick number two fed much sooner. The entire feeding process is one that shows a delicacy of relationship and degree of parental attentiveness that some ornithologists might be loathe to credit to a bird. A feeding parent constantly batters and works food very carefully in its bill before offering it to a chick. Then it gently and rather precisely offers a small particle, perhaps a worm, a piece of shrimp or a dragonfly directly in front of but not touch-

One of the chicks, now 4 days old, has taken a worm from its parent. At this early stage, the chicks have not learned to find food for themselves and both parents hunted for them.

ing the chick's bill. Should the chick fail to take it, the adult may cock its head and softly drop the food in front of the chick several times and we may hazard that this is a sort of training. In such fashion, the chick begins to pick food up from the ground and gradually learns to eat by itself. For many days, however, the chick receives by far the greater portion of its food from its parents. First pecking clumsily at the gentle offerings and gradually with increased strength, it gains accuracy with its evergrowing appetite. Unlike young song birds, such as jays and robins, the semi-precocial crane chick does not appear to use any well-defined begging postures or regular call for food. The parents are so attentive that the chicks are offered food almost constantly. The chick may even disinterestedly reject food, only to have its parent continually proffer and drop

food in front of it to gain its interest. On occasion the adults appear to work their mandibles rapidly in small sliding movements to gain the chicks' interest, sometimes pointing out a food item with this peculiar motion. At this stage of development, the young cranes' greatest needs are readily converted animal proteins and minerals. Like most young birds, they receive very little vegetable matter. On May 27, when the oldest chick was in its ninth day, Josephine carefully washed a single corn kernel and offered it but it was refused. Jo washed it again and swallowed it herself. Both Jo and Crip, like most adult cranes, showed some fondness for grains and would usually feed from their grain hopper two or three times a day.

The chicks were being fed, at this time, a carefully considered ration of high protein turkey starting crumbles, diced fresh shrimp, diced soft shell crab and hard-boiled egg yolk. This diet was supplemented with bone meal and codliver oil to guard against the plague of growing young cranes — rickets. Mr. Scott, working nearly a twenty-four-hour day, seven days a week, prepares each feeding himself and replaces the food at frequent intervals throughout the daylight hours. Some of the food items were carefully washed by the parents, whose good intentions would wash away the codliver oil. To prevent this, mealworms were soaked in codliver oil and fed to the youngsters. Chick number two took its first bite, by itself, when it was four days old. Later the same day the older chick was first seen to feed by itself, gulping a piece of crab covered with turkey starter. Despite these ventures, the chicks remained very much dependent upon their parents for food and continued to be fed by them for a long period.

The Whooping Crane paddock in Audubon Park Zoo seems to contain an almost inexhaustible supply of earthworms. Probing deep into the ground with open bill, grasping, feeling, and levering with the beak from side to side, Crip and Jo carried on a frequently successful worm hunt. Dragonflies and a few grasshoppers were caught after a short stalk and a lightning stab of the adults' long bills. These foods made up a large share of the young cranes' diets. The parents seldom ate the worms and insects they caught, but constantly offered them to the chicks.

In some respects Crip appeared to be the most attentive and constant chick feeder.

The brooding behavior of the family was of especial interest. Needless to say, no modern ornithologist has had an opportunity to sit down within fifteen feet of a Whooping Crane household and spy on its bedtime habits. For that matter, the entire breeding project has given us an opportunity to record the intricacies of Whooping Crane infancy. Either acutely sensitive to temperature or, more likely, very sensitive to the chick's reactions and need for shelter and brooding, Josephine broods the young each night and also during the day should weather conditions warrant it.

On May 27 at 5:50 p.m., the male began a strange ritualized tramping procedure in a high-grass area of the paddock. Josephine joined in briefly, as the chicks wandered nearby, and drew grass and weed bedding toward the center of the area. At 5:58 p.m. she lay down and drew more bedding grass about herself. The youngest chick pushed at the long tertials extending back near her "elbow" and gained entrance under her wing. Shortly, a minor uproar took place high up in the scapular feathers of the mother's back. A small, fuzzy head appeared and looked about. At 6:10 p.m., the chick tumbled out of its feather bed and Josephine arose. At 6:45, she again lay down after further grass tramping by Crip. Both chicks burrowed under the mother's wings, the older chick after pecking her strongly, an action which caused a low whoop as well as the raising of a wing. Suddenly the number two chick popped its head out near its mother's neck, pushed out, and walked through the grass jungle more than 30 feet to the water pans. After a long drink the determined little fellow headed back to Jo. Crip, however, chose the moment to proffer a worm. After gulping the worm, the chick began following Crip, constantly looking up and apparently waiting to be brooded. Crip, however, has not been seen to brood a chick since the second egg hatched. Jo began a low gargly rattling uh-unhhhhh, apparently attempting to call the chick to her. Finally the chick began a distress call, much different from the usual, musically plaintive, "peeeup." While still following Crip, it began a soft and cricket-like twittering, whereupon Josephine stood up and left the older chick



at the brooding site to find and lead the young one back. The chicks rarely showed much reaction at this stage to the calls of their parents, unlike pheasant chicks, for instance, which will run hastily to their mother at a brooding call. These crane chicks seemed to depend upon their parents locating and leading them. At 7:05 p.m. that night Josephine again lay down and brooded the chicks until 11:00 p.m. At that time she arose, stretched, got down over the chicks again and stayed in the same position until the family became active at five the next morning. Crip stood silently some three or four feet away during the night, awake and apparently alert for possible danger. The male was not seen actually sleeping through the entire nesting procedure, and following hatching was not observed to lie down at all for the first five days. Mr. Scott reports that constant checks through the night, at this time, always found Crip watching silently as Josephine and the chicks slept. The first few days following hatching, Josephine would brood down with

the chicks in several places as the evening drew on. By seven, however, she would end up brooding the chicks on the nest site. When the younger chick was six days old, the family spent its first night away from the nest. As with many of their actions, we might interpret this as a possible indication of their wild pattern.

While the Audubon Park enclosure is ideal for breeding cranes, rearing is another question. The vicissitudes of weather, disease and predators leave young chicks in a very delicate position. Despite their admirable parents, their loyal god-father George Douglass, and the skillful conscientiousness of Headkeeper Scott, a sudden flicker of chance and all is lost. One day as I watched and noted, three short but drenching rains fell upon the paddock. Josephine immediately attempted to brood and shelter the young. The smaller chick struggled to get under her wing, pushing to a warmth that might mean life or death at this delicate point in its existence. The larger chick vainly followed but could not

gain access to the maternal shelter. Josephine showed great anxiety, jerking her head about and calling — but apparently she rested in some improper position which would not allow the chick to get under her wing. Possibly this chick was attempting to enter improperly or Jo's injured wing was at fault. In any event, the chick was soaked and finally took shelter under a large leaf in a nearby bush. Another downpour two weeks later found Scott wading about a flooded paddock, piling straw around Josephine at midnight, attempting to help her keep the precious but fragile chicks dry.

The almost rhythmic, formalized tramping behavior associated with brooding raises some engrossing speculations. This action was first seen

though prepared food was available constantly, the adults foraged in the paddock, finding worms and insects for the chicks.

Mr. Conway took this photograph at the moment Chick No. 2 took its first bite of prepared food without urging, at 4 days.



at 8:30 a.m. on May 18, scarcely an hour before the first egg was reported to have pipped, and has frequently been associated with brooding ever since. It might possibly be important in the wild where chicks could have trouble walking in high vegetation or be easily lost. The flattened area around the brooding site may also help in the perception of predators, but, whatever its function it is distinct and readily separable from any of the cranes' other behavior. Always associated with some sort of brooding behavior on Josephine's part, it seems unlikely that it is any sort of food-seeking mechanism.

An unusual incident took place on the younger chick's sixth day which is illustrative not only of an interesting facet of Whooper behavior but also of the constant hazards which beset a rearing project. The small chick was leaving the food pan when it awkwardly rolled over between the short rims of food pan and catch pan (a larger pan in which the feeder was placed), landing on its back in a more or less wedged position. The chick vigorously tried to right himself. Instantly Josephine and Crip were there, anxiously calling. Jo extended her open beak about the chick, and the chick immediately turned over. It raised an interesting question. Did Josephine nudge the chick into an upright position? Actually, the chick *appeared* to use Jo's bill, which she did not close or hold the chick with, as a prop against which to apply its flailing feet.

At first the temperament of the chicks was cause for concern. Growing rapidly, before three days had passed the babies were having mild scraps. Rising to their full fluffy stature they would spar, each attempting to grasp the other's bill and twist it. These matches may well have their origin in feeding behavior. Not infrequently a chick will peck at a piece of food another is holding, and occasionally a pecking contest will ensue. Far and away the greatest number of encounters, however, seem to have some other origin. The chicks raised wings, grasped bills and thrust with their feet in a manner which showed little kin to their feeding behavior. Occasionally Crip and Jo became quite excited by an unusually vigorous foray. They put their heads down close to watch, and then, suddenly throwing back their heads, sounded their rattling calls.

Towards the keepers, Josephine is the more

aggressive of the two parents. Raising her wings, extending her neck and contracting her pupils, she advances stiffly in a menacing fashion. Or uttering a hoarse growling cry, like a tin can being pulled over close-set iron bars, Jo and Crip will sometimes approach obliquely, flattening their bodies in typical crane fashion. Frequently male cranes become very vicious and it is surprising to find Josephine the more aggressive of the pair.

Experimental work in several major zoos, both in this country and abroad, has demonstrated that cranes are best reared in a controlled scientific fashion. By removing the eggs as they are laid, it has been shown that in some cases as many as six clutches may be obtained. A careful program in New Orleans, for 1958, might result in the production of four or even six cranes in a single season. In my opinion, the eggs of the first two clutches should be incubated artificially and the young reared in brooders by hand. The end

result of such a program will be steadier, healthier birds much more easily handled for future breeding purposes. Brooder handling and artificial rearing greatly decrease the normal risks. Flash floods and downpours, predators, and the thousand unexpected calamities which plague rearing by the parent birds in outdoor enclosures are avoided. Now, too, it is time to recognize that the ways of nature have not been favorable to the Whooping Crane. Even if Crip and Jo could supervise two chicks each year to maturity, their program would be too slow for their species problem. Careful artificial incubation and rearing techniques are vital for 1958. George Douglass has led the way in the breeding project showing that the Whooper can, like any other crane, be bred in captivity under proper conditions. The New York Zoological Society has helped with its technical care and advice. Now the stage is set for the institution of a sound, modern, 1958 Whooping Crane Breeding Project.

Latest News of the Cranes

Just before this issue of *ANIMAL KINGDOM* went to press, Mr. Scott telephoned a report on the condition of the two Whooping Crane chicks.

The younger of the two—the bird hatched on May 21—then stood 40 inches tall, several inches taller than the older chick. The reason for the discrepancy in size is presumably the setback the older chick received in June when it suffered an internal injury. It is probable that one of the adults, getting up suddenly from the nest, stepped on the baby. Mr. Scott removed it from the paddock and for more than two weeks kept it in a brooder by itself. By careful supervision he managed to return the chick to the family without incident after it recovered from the injury. The accident, which occurred despite the constant watchfulness of Mr. Scott, points up Mr. Conway's argument that "brooder handling and artificial rearing greatly decrease the normal risks."

Commissioner Douglass has now prepared an additional paddock in which the young cranes will be liberated this fall, after they are old enough to leave their parents.

Mr. Scott will remain with the young cranes until August 4, and will then return to New York. Up to the present, there are no plans to post a special observer-attendant at the crane paddock after Mr. Scott leaves.



Growing Up with Wombats

By ROSEMARY FLEAY

The author and Wally, the temperamental Wombat, when Wally was six months old and still in the butting, scampering, rolling stage. Later he developed a habit of biting his friends.

All photos by David Fleay

DURING THE PAST few years it has been my duty to look after many young mammals and birds. This is a job that takes a lot of time and patience and is often disappointing, but at the same time it is always rewarding to see "my" young ones making good progress. Perhaps my favorites have always been the wombats. To most people these sturdy animals appear slow, lumbering, retiring and pig-like, but I have found them playful, attractive and affectionate pets.

My earliest association with wombats began when Miss Iola Woods, who had lived all her life on Flinders Island in Bass Strait, sent a baby wombat from the island to my father at the Healesville Sanctuary. This wombat, a soft-furred, docile gray youngster, was reared on the bottle and named "Wenda." She soon became the Sanctuary pet and roamed free most of the time.

Many visitors to the Sanctuary will remember Wenda's playful antics. Often on a busy afternoon, when the long narrow bridge spanning

Badger Creek was full of people, Wenda would come thundering along on her short legs and with head down charge through the crowd, causing a great scatter. Seemingly she enjoyed it all. Then she would appear in the kiosk at afternoon tea time. People sitting at the tables would suddenly become aware of something furry brushing against their legs. The table would heave as Wenda rubbed her ever-itchy rump against the supports and caused a minor earthquake among the crockery.

She would follow at heel like a dog and one afternoon she casually trotted right through the entrance gate, following some visitors to whom she had taken a liking. There was dismay in the Sanctuary when she was missed. Radio stations and police were notified, search parties were organised and people drove around the roads in search of the missing wombat. After following

Rosemary Fleay is the daughter of the Australian naturalist, David Fleay, who in 1947 brought three Duck-billed Platypuses to the Bronx Zoo. Mr. Fleay now operates Fleay's Fauna Reserve at West Burleigh, Queensland, and his children have been brought up with wild animals as pets.



Rosemary Fleay's studies of Wombats began at an early age, for when she was only two years old her constant companion was Wenda, pet at Healesville.

A young Wombat is no very attractive in appearance, with its sparse hair, large head and long claws. This youngster is Keith at age of just three months.

her friends for about two miles towards Healesville, Wenda tired of her liberty. She set back across country and was found at midnight impatiently scratching and banging on the Sanctuary gate — home at last.

We have found on many occasions since that domesticated wombats possess a marvellous sense of direction and when lost they travel for miles to get back home again. Wenda died in 1949 at the age of 15 — probably a normal life span — and we all felt a great loss. She had been one of the family and a playmate to me since my earliest years.

My next adventure with wombats began in June of 1949 when a tiny, two-pound, pink joey was brought to us. Its Victorian wombat mother had been killed by a timber truck on the Myer's Creek road near Healesville. Some hours later a neighbor noticed the movement of the hairless mite in the mother's pouch. The baby was soon wrapped up on a luke-warm water bottle and given two-hourly feeds from an eye dropper. We named him "Keith" after the bus driver who brought him to us. So tiny was Keith that my father felt a bit dubious about letting me keep him in case I was disappointed. At that stage it seemed hard to believe that this tiny handful

might grow into a solid, hundred-pound wombat.

Excitement, rather than disappointment, was in store for Keith's caretaker. Once the circulation was cut off in his leg by a thin strand of wool in his bedding of old woollen sweaters. Another time he burrowed down on the hot water bottle and was rescued next morning with a red glow to his usually pink skin. However he survived these mishaps and progressed well.

His hair began to grow and he filled out rapidly. The only part of him that didn't grow much was his ridiculous little stump of a tail. He began to nibble biscuits, carrots and grass. I would take him out on the lawn in the sun for a short period each day and he soon began to frisk about. He would career madly about the grass at full speed, making headlong rushes at my legs, veering off at the last second. He would roll right over, then flatten his body on the grass and waggle his head. Often he ran full tilt into my legs or other more solid objects, bouncing off from the impact. These crashes were terrific but wombats' heads are solidly set on their shoulders and form natural battering rams.

Keith was a wonderful one-girl pet. He would trot lumberingly at heel with a peculiar pigeon-toed gait and a poker-faced expression. If he



stopped to nibble grass and lost me, he would sit on his haunches — head in the air — and call loudly in his peculiar husky “chush-chush” until we were reunited. He was my pride and joy but a constant source of irritation to my teacher, who had to let me off early for lunch so I could rush home and give the wombat his bottle.

Keith was left at home with my father when we went on a seaside holiday. We were not there two days when an urgent telegram arrived: Keith was fretting and would not drink. So he was hastily packed off to us at the seaside where he promptly regained his appetite and enjoyed what must have been a wombat’s first seaside holiday.

Keith grew to 70 pounds in two and a half years and Australian Instructional Films made a documentary film for schools in which he starred. Towards the end of a hard day’s filming, when Keith considered he had done enough, he would

Haired out but still a baby, the little Wombat nibbles a blade of grass delicately, taking tiny bits from one end. This is one of the two babies from Flinders Island.



dive under the verandah and relax by digging an extension to his burrow beneath the verandah stumps.

When we shifted to Queensland in 1952 to start a Fauna Reserve, Keith travelled in the guards' van and developed a dislike for trains. He was hot (wombats do not sweat) and would not eat for the three days of the journey. At West Burleigh he gradually recovered and was getting to be his old lively self when, four months after arrival, he died very suddenly at the age of three years. We do not know what killed him but it could have been tick paralysis. I missed Keith terribly and did not think at the time that I could ever let myself be fond of another pet.

But wombats are irresistible. In August of the following year Mrs. Richard Fowler on Flinders Island forwarded a neatly lined biscuit tin fitted up with an artificial pouch. In it slept a four-pound baby wombat. He was a powdery-gray little fellow with "shoebutton eyes," two little white buck teeth and two white claws on one front foot. We named him "Wally." He thrived on his milk diet and grew into a lovable pet, the idol of children who would come specially to be photographed giving him his bottle. The temperamental differences in wild animals are interesting; one wombat is *not* like every other wombat. Perhaps he had too much handling; in any event he began to give warning nips, with the result that children holding him for a photo would take fright and drop him—generally on his head. Wally's attitude towards life became warped and he started taking real chunks out of people with his inch-long incisors.

Now weighing about 70 pounds (outsize for a Flinders Island wombat), he definitely resists friendly advances. He puts his head down, utters loud growls and charges like a bulldozer. There is no holding him, so Wally is now semi-retired—eating, sleeping, sun-bathing and playing vigorously by himself to let off surplus energy.

In August of 1953 Mrs. Fowler sent us a baby female wombat, named "Winkie." She was very tiny, very mild and apt to be a bit spoiled. When old enough to roam she made my bedroom her headquarters. Often I would return to find newly ironed clothes scattered all over the floor and Winkie fast asleep in the cupboard.

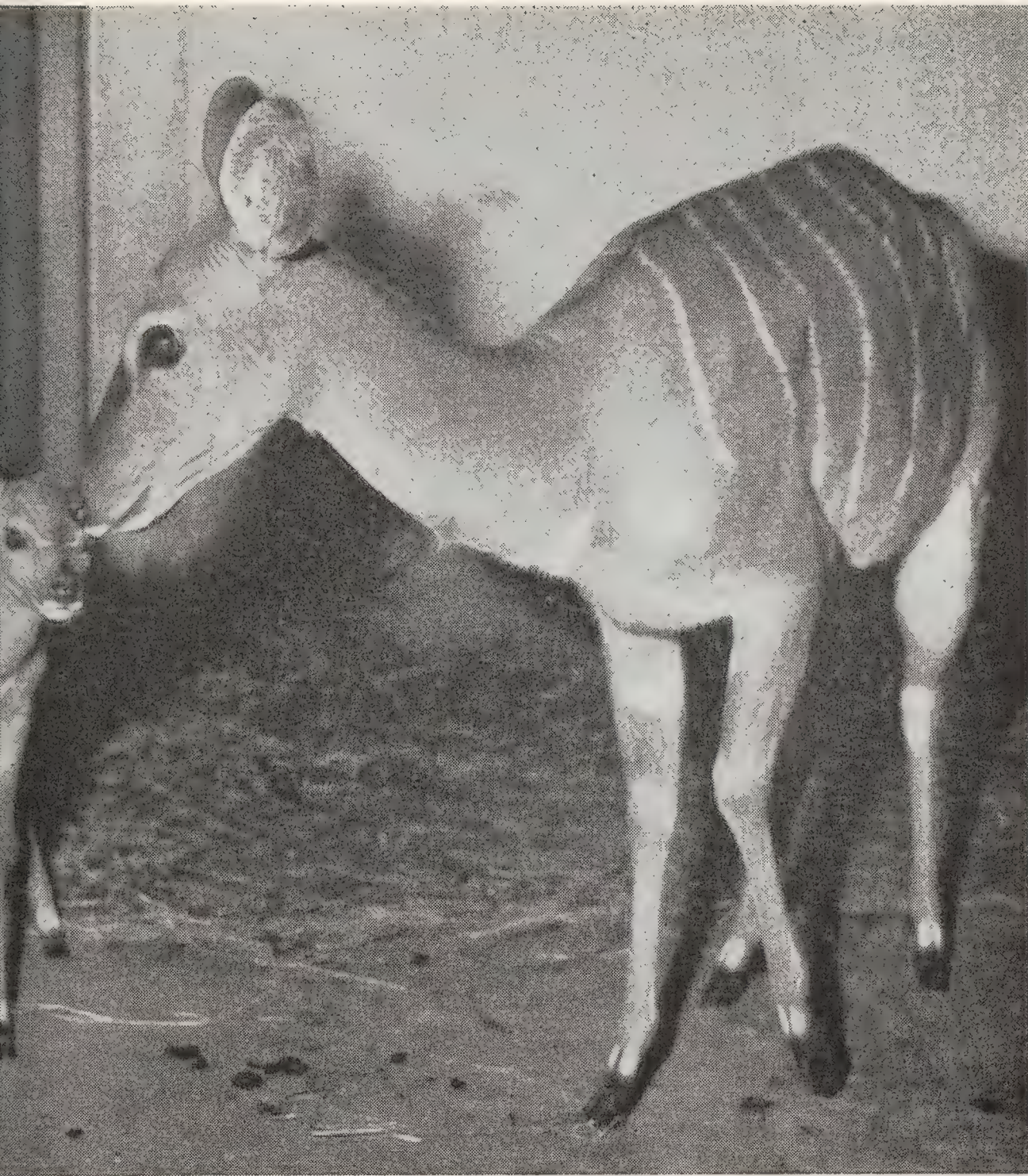
Winkie was chosen to meet Her Majesty

Queen Elizabeth II at Government House in Brisbane during the royal tour of Australia in 1954. Royalty didn't worry Winkie a bit. She munched the grass on Government House lawn, sampled the crêpe soles of the Duke's shoes and trotted everywhere after the Queen. Like all wombats, Winkie has a permanently itchy back. It began to itch on this important occasion and as she could not quite reach the spot, she ran under a nearby car and rubbed the itchy spot against a leaking sump. Then she raced to rejoin Her Majesty but her rump was covered in thick black oil. . . . However, it all ended happily and the Queen filmed Winkie's antics for the royal children.

Two and a half years ago Winkie accidentally ate broken glass from a test tube. She almost died but we managed to save her with careful nursing, sulfa drugs, paraffin oil and choice food. Then she developed pneumonia. I nursed her night and day and had to hand feed her with grass, blade by blade. She seemed to like company and would become distressed if I left her for long. Since then she has been temperamental, eating only choice corn on the cob, arrowroot biscuits, sweet potatoes and certain favorite grasses. She loves a daily walk and thinks it is wonderful to be fed upside down. She frets if no attention is paid to her each day.

She owns a little red pull-over which has been her inseparable companion since babyhood. This she sleeps on whether it is on cold concrete or in her straw bed. She stuffs one corner into her mouth and covers her head with the rest for darkness. There is always a major upheaval when Winkie has to be pried loose from her jumper in order for me to wash it. She parades around her enclosure and will not sleep until it is returned.

Though far removed from their natural environs on Flinders Island, Wally and Winkie seem to be thriving in Queensland in cool half-concrete enclosures. The only dangers are scrub ticks and the inevitable summer mosquitoes. So far Winkie has had three scrub ticks but we have discovered them in time and she has suffered no ill effects. Marsupials are not generally considered "personality" pets, but I must say that in my experience wombats, at least, are intelligent and affectionate and have a most delightful sense of humor.

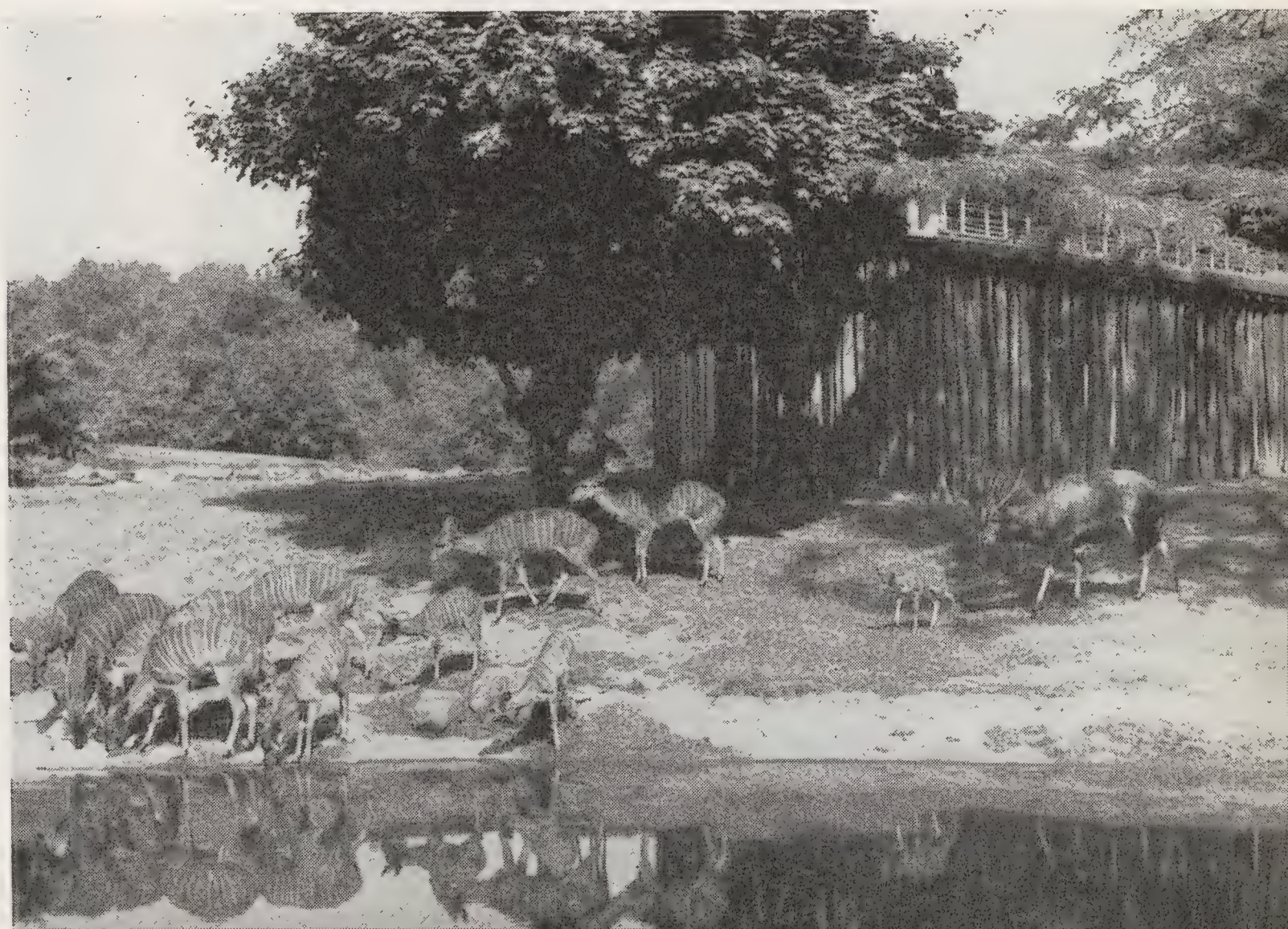


ZOO NEWS IN PICTURES

Photos by SAM DUNTON



Over the years we have learned that baby **NYALAS** are always (or *almost* always) born in January. For instance, four came along on January 4, 5, 9 and 10 of this year. It was a surprise to the Mammal Department to discover a fifth baby in the African Plains herd on June 14, and from the curiosity and interest displayed by the members of the herd when the little Nyala appeared on the plains a few days later, it was a surprise to them, too. In existence since the mid-Forties, the African Plains Nyala herd is thriving. Young bucks have to be removed to avoid competition and fights with the "boss" buck, and we now have a stable population of 15 antelopes.





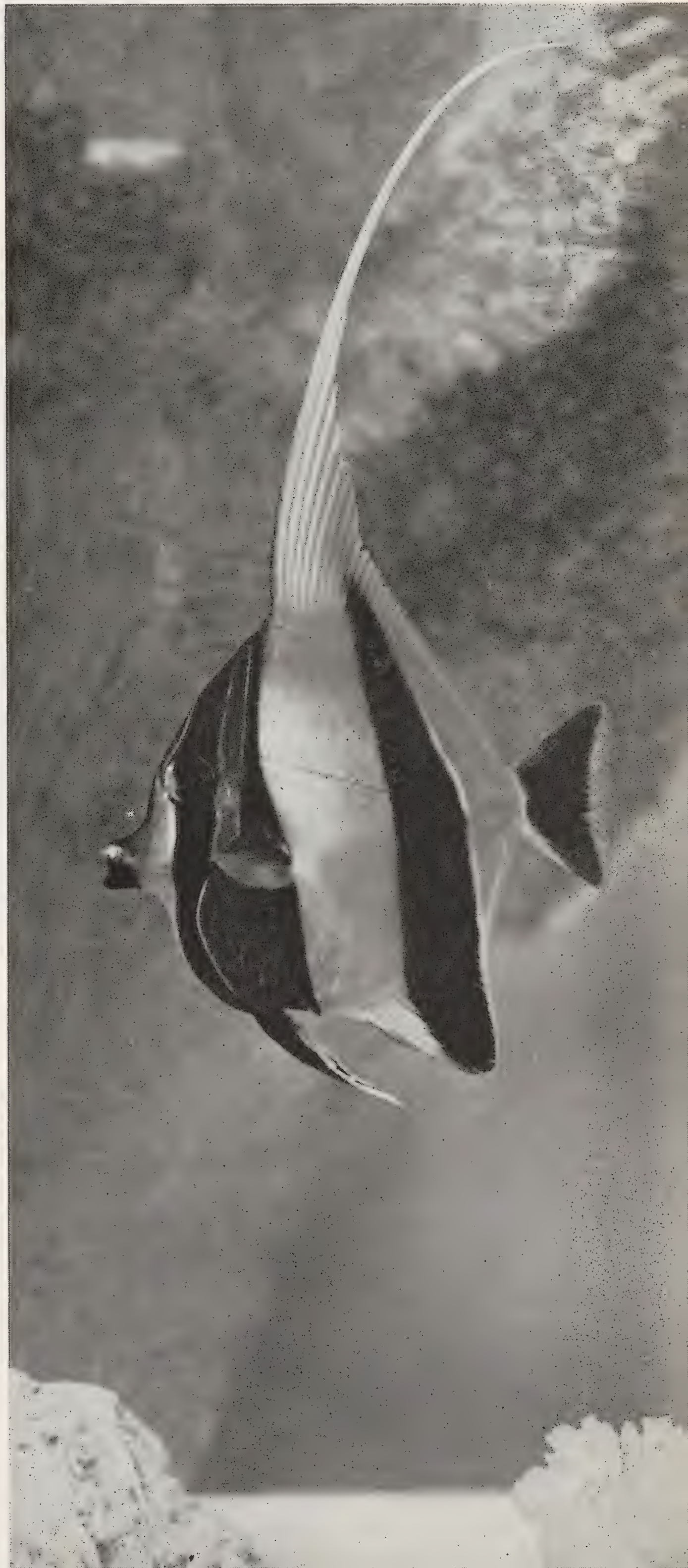
The **SEA-BAT** that ranges from the Red Sea to Japan and Australia is not often seen in aquatic collections, but we now have this young specimen at the Aquarium. We are not sure of its scientific name, but it is probably *Platax pinnatus*. Like the Moorish Idol on the opposite page, this is a youngster, but a seemingly healthy and vigorous one that should do well in the Aquarium tanks.

These young **ANOAS**, or Pigmy Buffaloes, are new arrivals replacing the old Anoa that died on January 10 at the age of 28 years, 5 months and 25 days — perhaps a longevity record for the species. The new male is a little more than two years old, the female just under one year. They seem to have settled down to a quiet existence. Their predecessor, too, led a blameless life except once when she mystified her keeper by appearing in her outdoors yard when he *knew* he had locked her inside. It was a mystery until he watched and saw her stand in her drinking trough, hook a horn over a rope that operated the door, and leap outside just before it went shut.



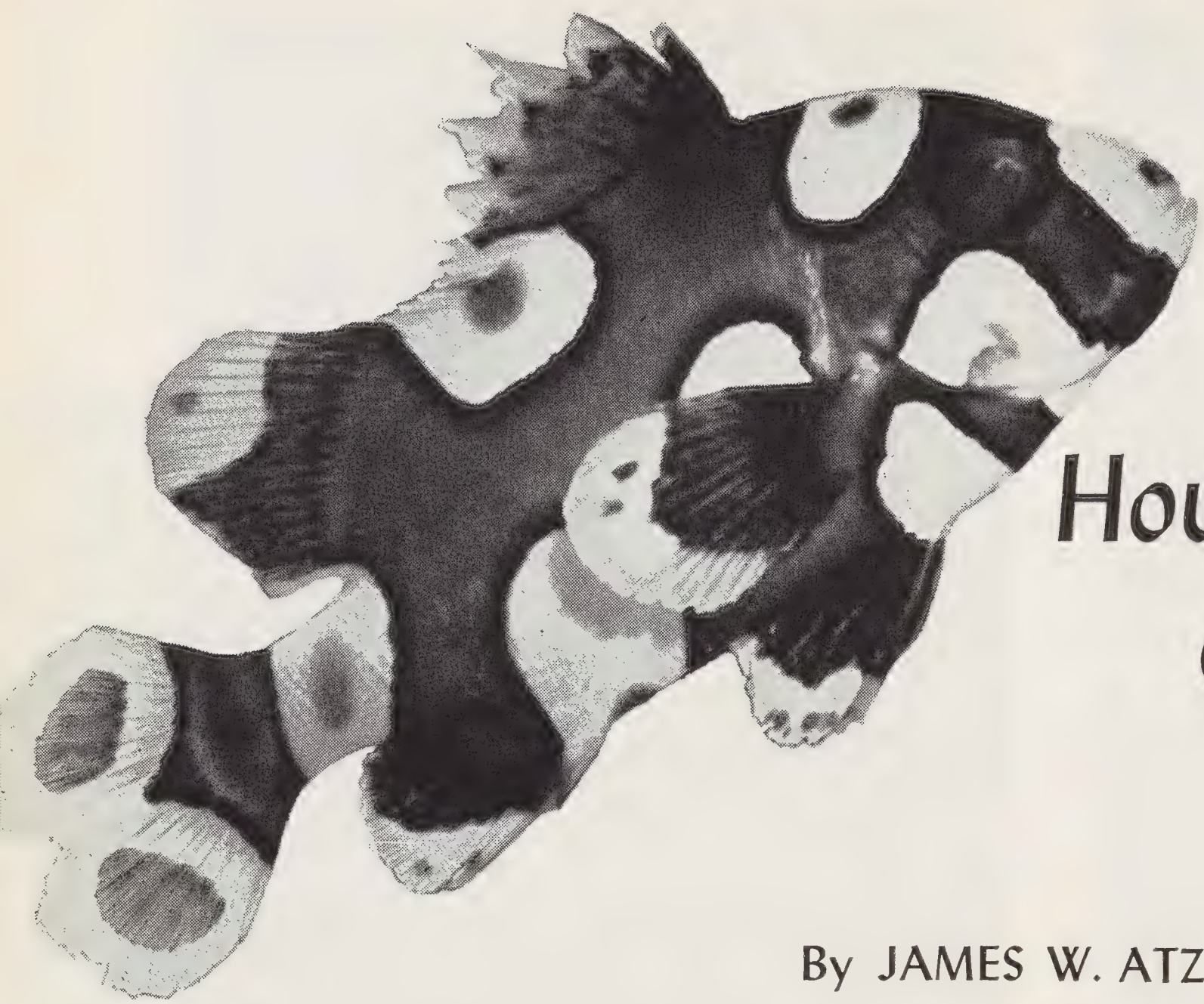


This picture really ought to be in color, for this exuberant fish is the **MOORISH IDOL** (*Zanclus cornutus*) of the Pacific and Indian Oceans and its colors of yellow and black (with blue, white and red trimmings) are as striking as its form is novel. This is a young specimen, recently acquired by the Aquarium, and as it grows older its body will become more compact and the long dorsal fin will become more scimitar-shaped.



Most of the inmates of the Children's Zoo are necessarily small and "pettable" domestic animals, but every year accidents or special circumstances contribute a few temporary visitors from the wild collection. On May 30 twins were born to one of the **CHINESE WATER DEER**, but one was malformed and it and the mother died. The surviving fawn was immediately welcomed in the Children's Zoo, named "Su-lin," and has become a favorite subject for amateur photographers. In the picture at the left, Su-lin is being held by Zooperintendent Dalsgaard. The young **GUANACO** below, being forced by Attendant Gail Roemer to go one way whereas it wants to go another, has the name of "Monaco the Guanaco." It was born July 3.





How to Confuse an Ichthyologist

By JAMES W. ATZ

EVERY MAN PRIDES HIMSELF on knowing his job and the ichthyologist is no exception. In a way, fishes are the tools of his trade; each ichthyologist wants to be able to recognize and name as many different fishes as possible. This faculty is obviously of practical importance—it is a tremendous time-saver if nothing else—but professional pride also enters the picture, since on-the-spot identifications represent a tangible measure of a man's experience and knowledge. It would be a pretty blasé fish man who did not experience a feeling of satisfaction on being able to recognize and name on sight some unusual fish, particularly if it had stumped his colleagues.

There are so many different kinds of fishes, however, that no expert could ever know *all* of the 25,000 species estimated to exist. But sheer number and variety are only two of the complicating factors in fish identification. It sometimes seems as if the fishes themselves willfully set out to confuse the ichthyologist, for although most of them resemble their close relatives and can rather easily be assigned to the proper Family or Order, some not only appear completely unlike the other members of their group, but masquerade as something else, looking as if they belonged to some entirely different assemblage. There are, for example, the electric eels, eel-cats, swamp-eels, cusk-eels and eel blennies, all with long, sinuous,

eel-like bodies, but none are related to the true eels best known to fisherman and cook. There are minnows that look and act like pike, seabass that resemble damsel fishes, and jacks that could be taken for mackerel. Plenty of opportunity therefore exists for the fish man to be led astray as to the identity of his charges; the prideful ichthyologist usually gets his come-uppance just frequently enough to keep him from becoming too pretentious.

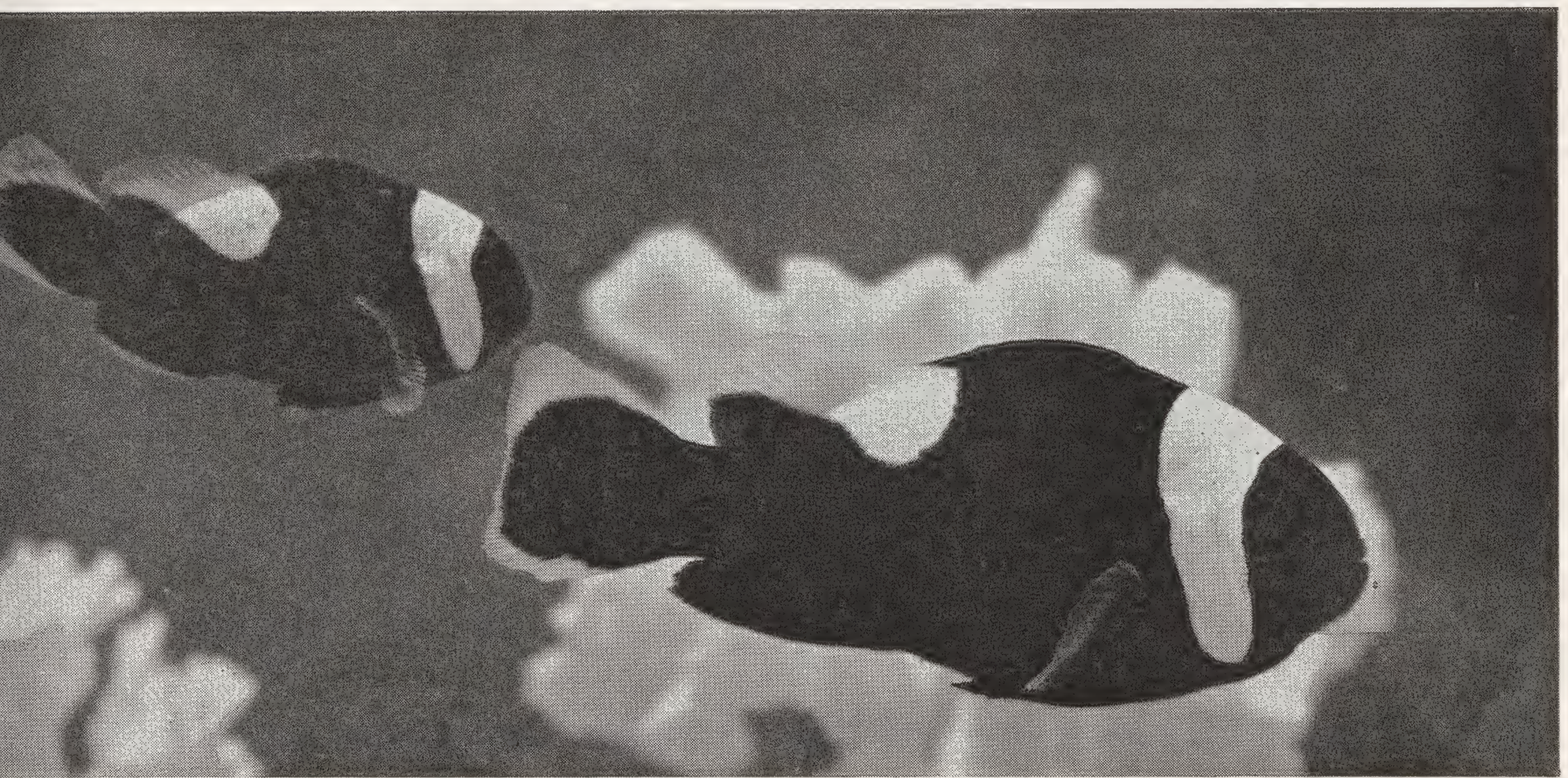
The reason for these reflective comments is

The fish that puzzled the author of this article is shown above — and opposite is a true clownfish, the White-saddled Clown. Typically the Clowns have bold markings, so the confusion is natural.

that not long ago I received such a salutary, and instructive, jolt. I first saw the mischief-making fish at the wholesale fish establishment of Mr. Ross B. Socolof, one of our leading commercial fish importers, from whom the Aquarium has purchased many exotic marine species. One look at the fish's bizarre coloration showed that Socolof had not exaggerated when he excitedly telephoned me to tell me of a strange fish just arrived by air from the Philippines. He had received a fish just like it about a year before, but it was very small and half-dead on arrival. Mr. Socolof had immediately written to his collector

in the Philippines to be on the lookout for additional specimens. It had evidently taken all this while before another could be captured. But it appeared to have been well worth the effort; the present fish was large enough to make a striking exhibit and swam about vigorously, well aware of its surroundings. Its colors were, of themselves, not unusual. They consisted of immaculate white and a few shades of warm orange-brown, but the way they were arranged was so unusual that even with the living and obviously untouched fish in front of us, we could not help playing with the idea that an unscrupulous painter had decorated the specimen. Only caprice could explain the location of the nine white blotches on its body as well as the irregular white border on each fin. Moreover, to add to the confusion, all but three

were its swimming motions which showed the same lazy, side-to-side swaying movements, the same rowing actions of the pair of pectoral fins that clownfishes regularly practice. These periods of remaining more or less in one place were interspersed with short darts here and there, again in the manner of a clownfish. It *had* to be a clownfish. Yet if it was a clownfish, I knew it was not like any that had ever been described before. Thanks to the efforts of Dr. Leonard P. Schultz, Curator of Fishes of the U. S. National Museum in Washington, there is a scientific paper that summarizes and illustrates the various species of clownfishes, and all of them had color patterns distinctly different from those of the present fish. The most likely answer seemed to be that our fish was a new species.



of the white areas had a smudge or two of brown somewhere near the center, and in the white blotch encompassing the fish's mouth and nose, this took the form of an absurd Hitler-style mustache.

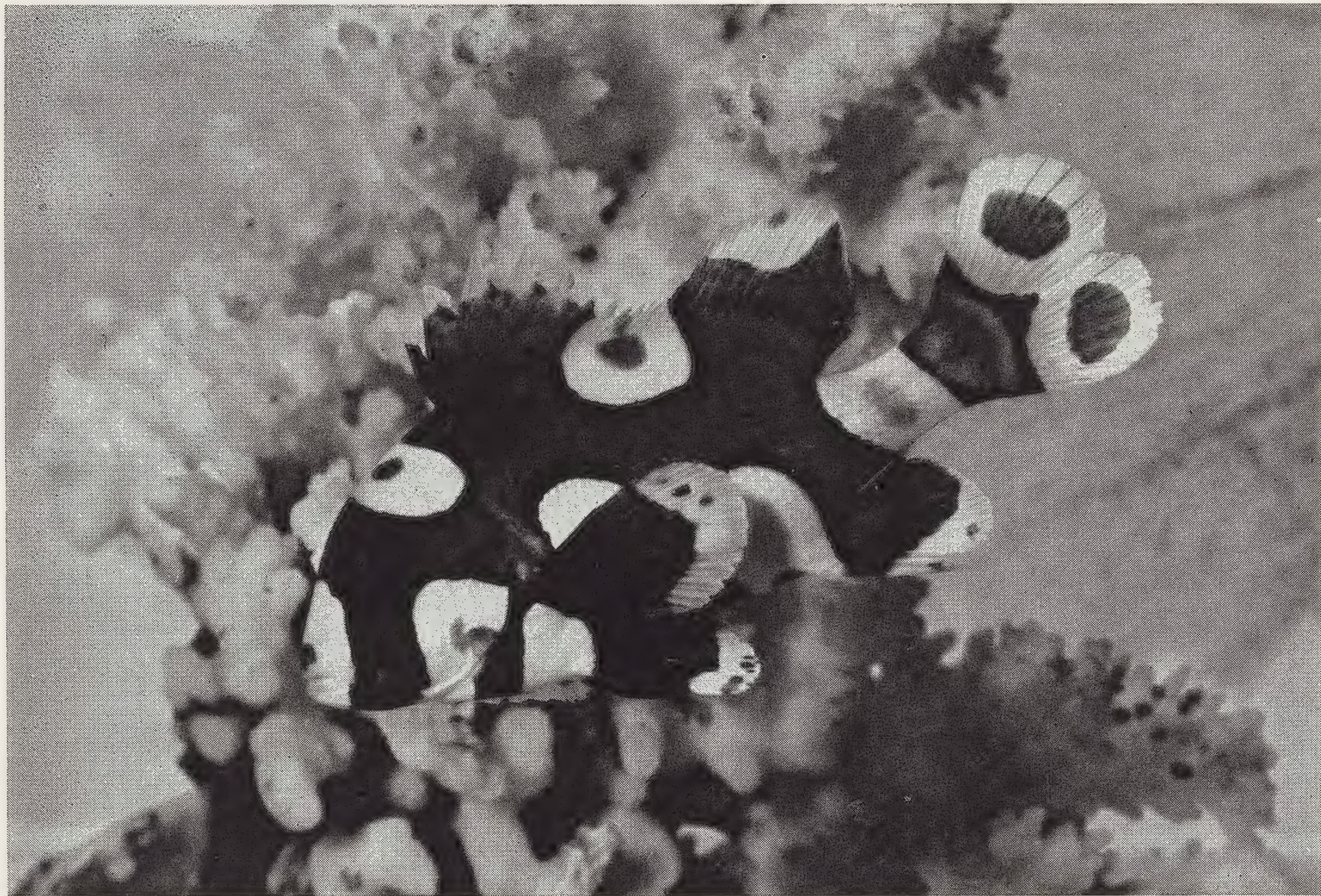
There the fish was, but what *was* it? The only fishes that either Mr. Socolof or I had ever seen that resembled it at all were the clownfishes. These small inhabitants of the tropical Indian and Pacific Oceans exhibit the same bold light-on-dark color patterns, although in not so complicated a form. The newcomer was also shaped like a clownfish, but most characteristic of all

For nearly a month I lived in the pleasant anticipation that I would have a hand in the discovery of a new species of fish. It seemed particularly appropriate that the new Aquarium, even before it opened its doors, should have in its collections a striking new species. Then came a letter from Dr. Schultz identifying the fish as *Plectorhynchus chaetodonoides*, a member of the Grunt Family. There wasn't the slightest doubt about it, and to make matters worse, the fish has been known since 1800, is widely distributed in the western Pacific, and is not only described but illustrated in more than one of the standard ich-

thyological works covering that region. The fact that the great majority of grunts look and act entirely differently was not really much consolation.

It was a chance remark by Staff Photographer Sam Dunton that enabled me to extract from this

coral reef such as this species frequently inhabits, you would not take it for a fish. This particular kind of *disruptive coloration*, as it is called, is found among other fishes besides one or two clownfishes and grunts. A few wrasses, marine basses and frogfishes also possess color patterns



Look at this photograph with half-closed eyes and the disruptive coloration of the fish will be apparent. Against a larger and more boldly broken coral background, the fish disappears.

rather humbling experience something more than an awareness of the great variability shown by certain grunts and their close relatives. Sam was disappointed in the way one of his photographs of the new specimen had turned out. The image was sharp and the lighting good, but somehow the fish did not stand out from the background of coral that we had provided for it. Suddenly it flashed through my mind: the reason for this was the fish's peculiar coloration. That was the function of the strange blotches. They break up the fish's outline and form. Although you might see the fish against the busy background of a

that are composed of bold, light-colored, sharp-edged blotches irregularly placed on a darker background. A good many other patterns of disruptive coloration may be found among fishes, but this is one of the most startling — and senseless until you think about it.

The unusual swimming motions shown by the erstwhile new species — motions quite unlike those of any other grunt that I have seen — may be associated with the fish's unusual color pattern. The double similarity it shows to the clownfishes, both in coloration and swimming, is probably not accidental.

Since my misadventure with *Plectorhynchus chaetodonoides*, the Aquarium has obtained two other members of the same genus, also from Mr. Socolof. Needless to say, I had no trouble identifying them.

Has the Nest of

THE KING VULTURE

Finally Been Found?

By WILLIAM E. LUNDY

IN JANUARY of this year Dr. Carl B. Koford, then the Resident Naturalist of Barro Colorado Island, was walking the beautiful Armour Trail when a sudden movement on the jungle floor attracted his attention. A few moments' stalking revealed an unexpected sight: perched on a log a few yards away was an immature King Vulture, frightened but defiant.

Although the black primary feathers of its wings were well developed, the tail feathers were almost non-existent, and its body was still covered with soft, fluffy, white down. Its neck and head were still sooty-black and only the tip of the beak gave promise of the bright colors that would later spread to the head and neck.

Well aware that this was a rare ornithological find, Dr. Koford hastened to take photographs—probably the first ever made of this species while still in the downy stage.

Back at the Laboratory, Dr. Koford told the attendants of his discovery and cautioned them not to disturb the youngster but to be on the lookout for its parents.

"I know the bird," a Colombian laborer remarked. "I put it there at Armour 8."

(All trails on Barro Colorado, the "laboratory island" in the Panama Canal Zone, are named and numbered at intervals of 100 meters).

"Well, if you put it there, where did you find it?"



The King Vulture may have repulsive feeding habits, but it is really a clean and actually beautiful bird, with orange, red, black and blue in head, caruncle and neck.

"At Armour 12. I thought it was an eagle, and was lost."

Just why he picked up a "lost eagle" and carried it 400 meters along the trail never became clear, but the upshot was that the bird was banded and carried back to Armour 12.

Interesting as the downy King Vulture was in its own right, its discovery opened up an even more exciting prospect: there must be a nest nearby. That was exciting because the nest of the King Vulture has been completely unknown.

I remembered clearly an incident of 37 years before when I had made the close-up acquaintance of this big, spectacular vulture. On a jungle trail in the Bocas del Toro province of Panama I had met a native hunter returning with his kill. In a sack thrown over one shoulder he carried a half-grown peccary, while from the other hung a King Vulture, "El Rey" as it was called locally.

What a regal appearance this bird must have made when alive and erect! The hunter, quite proud of his prize, wanted me to admire it. He called my attention to the stout legs and the feet that, by a layman, might have been mistaken for an eagle's; the bare, heavily wrinkled neck splotched with orange, purplish-red and black; the large orange-red head with pale blue cheeks.

The dull red-and-black beak was long and hooked, and an orange caruncle protruded from the base of the upper mandible. Light blue-gray feathers formed a "collar," while the body feathers and inner part of the wing were creamy white. The outer half of the wings and the tail formed a black band.

And how very clean the "King" appeared, despite its repulsive feeding habits!

As a grand finale the hunter lifted the bird until one wing tip just touched the ground, while the other extended considerably above his head. It had a wingspread of not less than six and a half feet.

I was interested, and the hunter told me all he knew, or believed, about the bird. It was seen but rarely, one or two at a time, at no certain season; it was not good for food because it fed on the dead; other vultures held it in respect and would not feed from a carcass until the King had taken the choice parts.

I happened to ask where the King Vulture nested, and that ended the conversation. My

hunter did not know, and it embarrassed him to have to admit it. Certainly it did not nest in that part of Panama, he said, or he and the other hunters would know it.

The hunters were not alone in their ignorance. I remember an evening on Barro Colorado in 1937 with Dr. Frank M. Chapman when I remarked that during the morning I had had the good fortune to see a pair of *Sarcorhamphus papa*.

"A pair of King Vultures?" Dr. Chapman exclaimed. "Where? What were they doing?"

He was obviously disappointed when I reported that they were doing nothing very revealing, merely feeding on the carcass of a small mammal in a ravine. Still, he was interested to know that a pair was around — "for," he added, "some day someone will discover their nest."

Dr. Koford had the mystery of the King Vulture's nest very much in mind, and the finding of a youngster only so recently out of the nest spurred a thorough search. He made a careful examination in and under old logs in the area where the youngster had been found, but without result. Eventually, however, he came upon bones and wads of hair at the base of a large cativo tree. Much of the hair appeared to be that of a sloth.

Examination of the tree with binoculars disclosed a large hollow some ninety feet above the ground. So dense is the canopy formed by shorter jungle growth that one might pass the cativo innumerable times without being aware of the hollow place in its trunk.

The bones and the hair, Dr. Koford reasoned, were the indigestible remains of meals regurgitated by the young vulture, possibly while still a nestling. It was likely that the nest would be found in the hollow.

Determination of *that* point was not going to be easy, for the tree had a circumference of 15 feet, its lowest limb was some 40 feet above the ground, and the hollow place was 50 feet higher still.

The adult birds were not seen around the tree, but there were several feathers from adult birds

This is probably the first photograph ever made of a King Vulture chick while still in its downy state. When the youngster was disturbed, it made harsh and gasping noise by sucking in its breath.

Photo by Dr. Carl B. Koford

on the ground, indicating that at least one had visited the scene recently.

When two days passed without the parent birds being seen, and no new feathers being collected, it was feared that the "Prince" had been abandoned, and Dr. Koford began to take food to it. I accompanied him on one of the trips.

As we drew near, the youngster "loped" away for a few yards, but by approaching slowly Dr. Koford was able to offer bits of meat on the end of a 30-inch stick. Three morsels were snatched greedily and swallowed, but the fourth was rejected. All the time the bird kept its wings half

spread, head and neck thrust forward, while making gasping noises by the intake of its breath.

Having to return to Balboa that afternoon, I mentally bade the Prince goodbye, for it seemed impossible that a bird not yet able to fly could long survive on the jungle floor, considering the number of predators on the island.

But as the weeks passed, the news of the bird's progress that reached me continued good. On several occasions the parents had been seen perched in the cativo and once one of them had flown from the ground near the youngster. The Prince's tail feathers were fast developing and it





had become tame to the extent that it permitted Dr. Koford to stroke its head.

Then one day it left the ground and was found perched on a liana ten feet above ground. The following day it was at a still greater height, and was exercising its great wings by practicing flying without loosening its grip on the vine. Two days later it had arrived at a perch 90 feet above ground.

When word reached me that an attempt would be made on February 17 to examine the hollow place in the cativo, I made preparations to be present. When I arrived with Dr. Koford, William Kosan had already started a spike ladder up the giant tree. With him was Miss Elizabeth Marsh who had spent several days observing and photographing the "baby" as well as its parents on the

occasions when they visited it. Unfortunately, she had not seen the actual feeding.

There are certain practical difficulties in scaling the tall and almost limbless trees in a tropical rain forest. Big and little lianas, epiphytes, mosses, fungus and ferns growing on the trunk, and foliage of nearby smaller trees and shrubs, make the shifting of a safety belt next to impossible. A makeshift safety line had to be devised which would not have to girdle the tree. Each loosened liana, or plant disturbed, filled the air with chaff which blew into the climber's eyes. The driving of spikes into the trunk brought forth hordes of ants. The spike ladder crept

Ninety feet above the ground this hollow place in a gigantic cativo tree was suspected of being the nesting place of the King Vulture. But was it? To the layman, the evidence was all but conclusive, but naturalists on Barro Colorado are not sure. Maybe next nesting time —

Photo by Dr. Carl B. Koford

slowly upward, but at the end of the second day, when our time ran out, Bill Kosan was still short of the goal by 20 feet. Operations had to be suspended for another week.

I was not present for the final "dash" to the hollow on February 24, but Dr. Koford told me about it two days later.

"We reached the cavity about 1:30 o'clock in the afternoon," he said. "It was formed by a fallen limb, and had rotted out, leaving an opening three feet high and fourteen inches wide. It has a level floor eighteen by thirty-three inches, and ample space overhead. It is large enough for a condor — in fact, the dimensions are almost identical with those of a condor's nest I measured in a cliff in California."

I wished he would skip the statistics and end my curiosity! Was it the King Vulture's nest or wasn't it?

"The site is perfect," Dr. Koford went on. "It is perfect — except that there are two inches of water on the floor of the hollow."

"And that means . . .?"

"This is the middle of the dry season. Allowing for the incubation period and the size of the young bird, the egg must have been laid sometime before the end of the wet season. It stands to reason that there could have been even more

water in the hollow at that time. There is a part of the hollow that is dry and sheltered even now, but . . .”

His voice trailed off. But I wanted at least a little more certainty.

“Would you say that the *chances* are that it was the nesting site?”

Dr. Koford’s reply was just what I expected a scientist to make. “The evidence is not there. I searched the hollow and found nothing that would let me say the birds had inhabited it.”

But then he grew more cheerful. “Anyway, we’ve made some progress. The downy young has been seen, we know the birds nest on the island,

and the approximate nesting site. Perhaps by careful observations next year we’ll be able to be sure.”

So there it is. Oddly, I can’t be sure I am as disappointed as I ought to be. Even during the exciting period when the finding of the nest seemed a certainty, the thought often ran through my mind:

“Watch out now; you’re going to be disappointed if it is the nest, and you can’t ever again tell about the King Vultures you’ve seen and be able to end your story with: ‘*And you know, to this day the nest of the King Vulture has never been found!*’ ”

At this school in Paraguay

HERPETOLOGY IS A PRACTICAL SUBJECT

By ERIC J. PHILLIPS

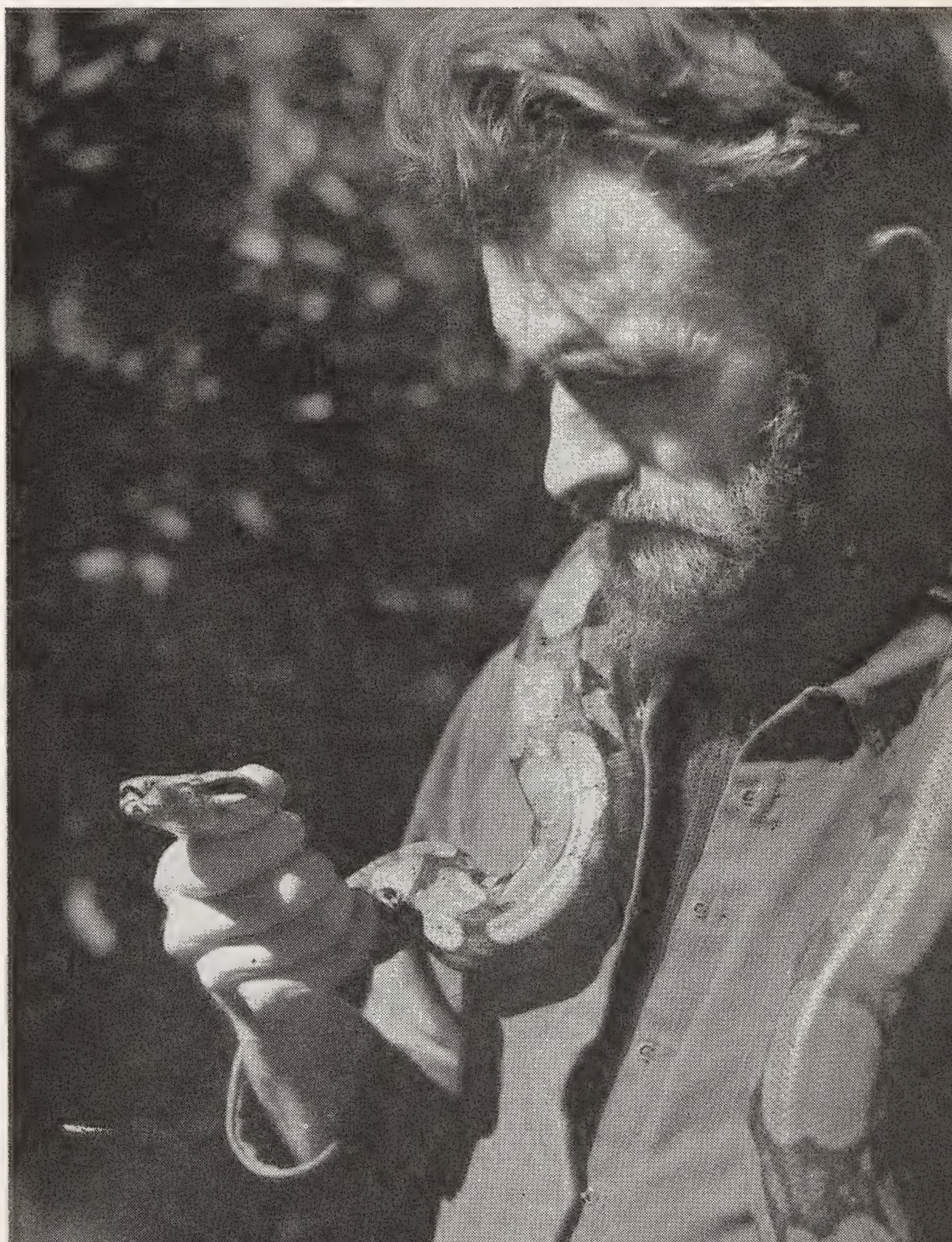
Sociedad Fraternal Hutteriana of Primavera, Paraguay

EDITOR’S NOTE

IN THE EARLY SUMMER of 1954 a letter to the Director of the Zoological Park was referred to the Reptile Department for answer; it came from Brother Eric J. Phillips of the Sociedad Fraternal Hutteriana of Primavera, Paraguay, and was a mere query as to whether the Zoological Park would be interested in receiving occasional shipments of live reptiles from that part of the world. Various Americans passing through Paraguay, it seemed, had noticed the small natural history collection Bro. Eric was forming, and had said that he ought to get in touch with the Bronx Zoo.

The Reptile Department was, of course, interested, and Dr. James A. Oliver wrote to Bro. Eric to that effect, sending a list of snakes, crocodilians, turtles and frogs from his area that we would especially like to have. Inquiries such as

**Bro. Eric J. Phillips and a friend —
a Boa for the Bronx Zoo**



this are not infrequent, and it is seldom that anything comes of them — but you never know.

Bro. Eric's prompt reply led us to believe that something would come of this contact, for he was obviously no armchair naturalist. It was getting into the cold season, he wrote, and he could not promise to fill our request very extensively until warm weather came, but then it would be easy enough. Would small caimans be satisfactory? He knew just where to get them in the Paraguayan summer.

"We take them by hand in the holes that go up into the river banks from the underwater level," he wrote. "I stand or kneel in the mud and water and reach up with my arm. If I don't get bitten, I grab the tail and sling the caiman up on the bank and the others pounce on it with a sack. Eels and fishes frequent these holes and sometimes a frog, so on a good day we sometimes bring home as many as 60 fish from 8 to 14 inches, and a big eel up to 40 inches."

Any herpetological collector who thinks nothing of groping blindly in an underwater hole in the *hope* of encountering even a baby caiman has Dr. Oliver's respect. He wrote Bro. Eric that we would be delighted to have small caimans, but that we certainly didn't want him to lose a hand — or an arm — for our sake. He never bothered to reply to this timid warning — but several excellent small caimans came to us a few months later. As far as we know, he got them by grappling under water.

Since 1954 the exchanges between Bro. Eric and the Zoological Park have been many. From him we have received a most interesting series of reptiles, several of which we had never before exhibited, and in return we have sent books and chemical apparatus for the laboratory of the school in which Bro. Eric is a teacher.

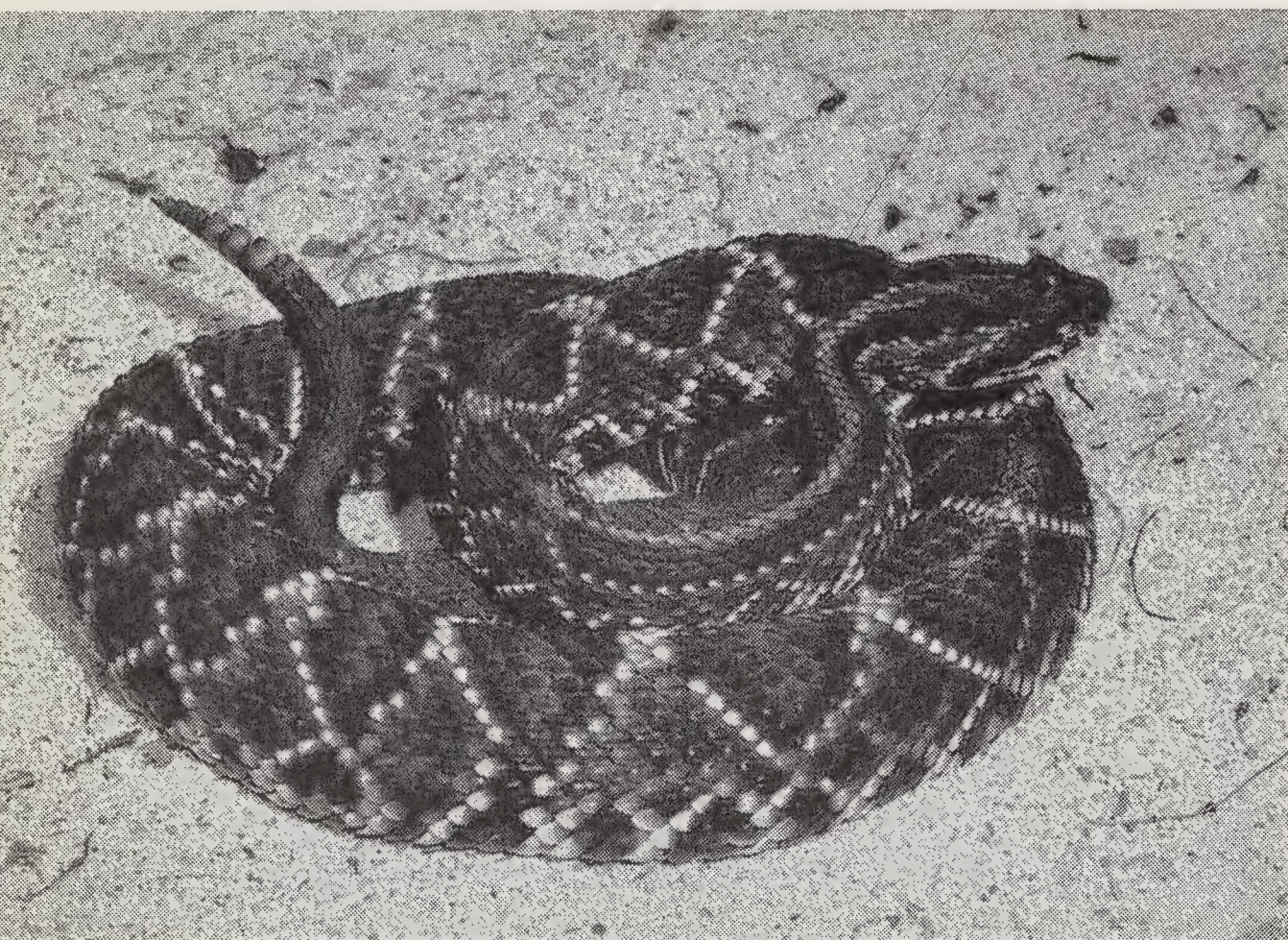
Recently we asked Bro. Eric to write of some of his experiences with his reptiles. His article follows.

STUDENTS OF BIOLOGY in the schools of the Society of Brothers in Paraguay have a wide scope for field study literally at the school's door. Snakes abound, and of the 141 reptiles listed for this area, 93 are snakes. Our herpetological studies may attempt to be formal, and pursued at stated academic intervals, but a good part of the time they are informal and unexpected, as when some child comes running and shouting that an "enormous" snake has been lo-

cated. It is what I call practical herpetology.

There are three villages housing somewhat more than seven hundred persons, of many nationalities, all working and living as one unit in a Christian community of goods. These villages lie about a hundred miles northeast of Asuncion, in an undulating region where plains alternate with mixed subtropical forests on the low hills. The gray clay "camp" soil is either bog and swamp or cracked hardpan, according to the time of year and the rainfall.

Our most dangerous snake is the Crossed Pit Viper (*Bothrops alternata*), which strikes without warning and with little provocation and is the cause of most snakebite fatalities in the neighborhood. On being taken, specimens of all ages have feigned death or hung limp — but suddenly they give a powerful convulsive wriggle and attempt to bite. I am well aware of this trick now, and watch out for it; one once performed in this way for me and its fangs passed



The only rattlesnake in the neighborhood of the school is the South American Rattlesnake. Bro. Eric reports one over 7 feet long, a new record. This is a smaller specimen in the Zoo.



through its own lower jaw and ended half an inch from my thumb.

It is quite common in this area. Specimens up to nearly 6 feet in length have been killed and smaller ones are likely to be anywhere. The larger ones seem to hang around the workshops, presumably on the lookout for rats.

It is not a good snake to have in places where people are working or playing, but on the other hand one doesn't *always* get bitten. One of our boys casually stepped over a Crossed Pit Viper as he was leading a children's group through a path in tall grass, and nothing happened. As soon as the snake was seen, it was of course surrounded and taken, but not before it had struck several times.

Our one and only rattlesnake is the South American Rattlesnake (*Crotalus durissus terrificus*), and although I see that the largest one known to Dr. Klauber and reported in his book on the Rattlesnakes was about 59 inches long (1 m. 52 cm.), a much larger one bit a dog at the school (it died in about 3 hours). This snake was just over 7 feet long (2 m. 18 cm.).

The rattlesnakes are said to be entirely nocturnal but we have seen them in the daytime in the deep forests or crossing paths and roads. They give considerable warning and hiss and rattle in

The tail of the Paraguayan Coral Snake gives a good imitation of a snake's head, rearing up and jerking and striking most convincingly. In this photograph the tail is at the right.

the usual alarming way. Unfortunately for one's peace of mind, there is a small grasshopper that makes a similar rattle. It is disconcerting to hear a rattle and not know whether the maker of it is going to strike or fly away.

One hot January afternoon we attempted to capture one of these rattlesnakes to send to the Zoo. Finally it escaped into a hole under a log, enormously complicating the business of getting it out alive, so it was thought better to kill it as the spot was quite near the village. Eventually the snake was hooked out and thrown clear, but it immediately coiled and struck. I jumped as I have never jumped before and fortunately was already just out of striking range, but I shan't soon forget the sight of the yellow, open mouth and unsheathed fangs coming through the air.

Most casualties from the snake have been at night or in moving logs or piles of leaves carelessly. Encounters with the rattlesnake are really rare and we do not have more than a couple a year.

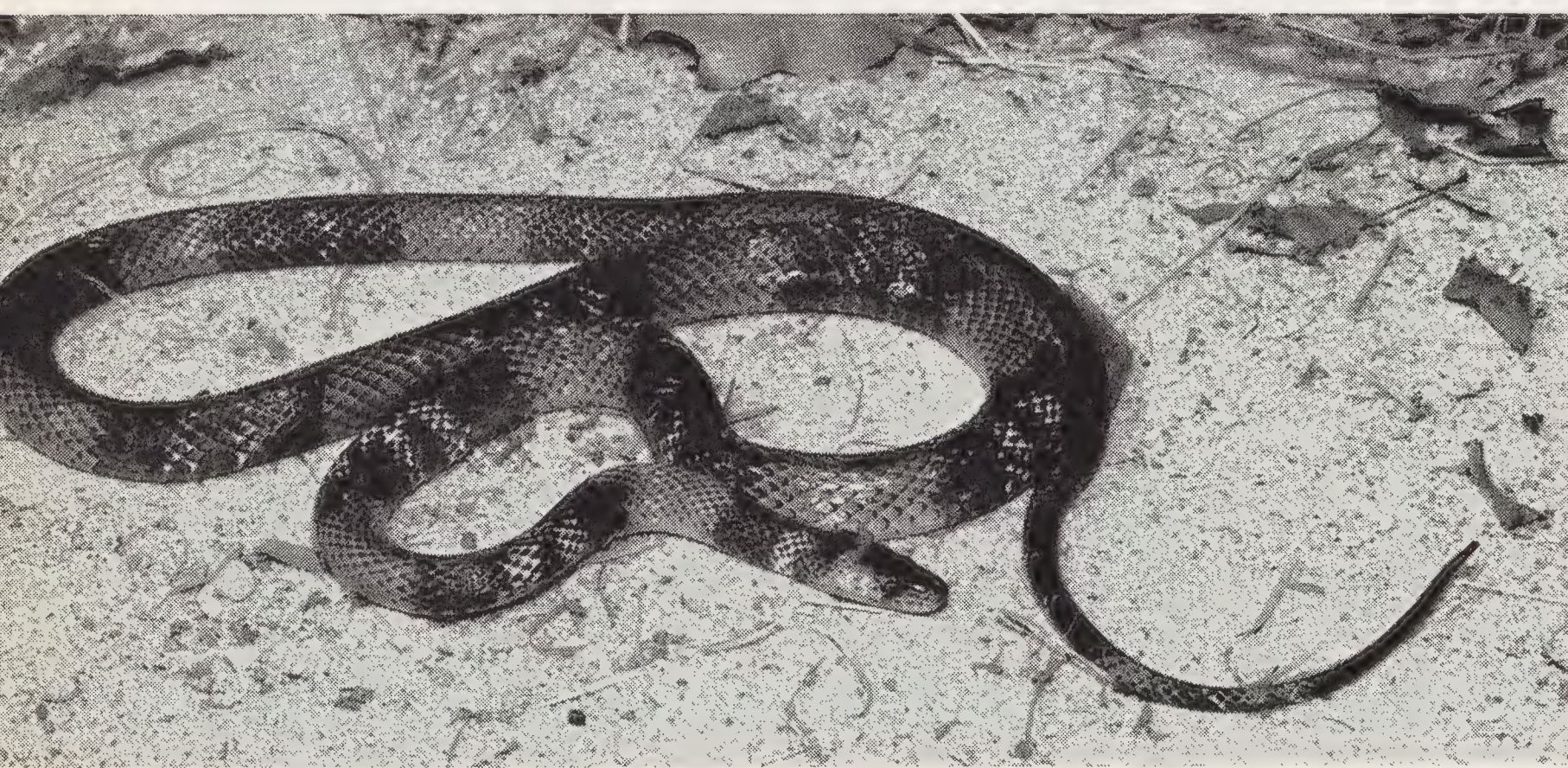
On another occasion a group of children was

walking along a cart track through the forest and came upon a family of twenty or so coati-mundis high up in a surupay tree. These coatis make entertaining (and mischievous) pets, and nothing would do but that everybody should stop and try to catch one. The first I heard about it was the familiar shout that an "enormous" snake was out there by the tree.

I went into verify this but could see nothing until a hiss and a rattle sounded almost at my feet. There, coiled and with head raised, was a rattlesnake. The boy who was leading the group had been even nearer when he made the discovery, and he could be thankful that it was a

coiled tail like a head and jerking and striking around in a bewildering way. After watching the wrong end act like the right end, one can understand the local belief that coral snakes bite with their tails.

I have, frankly, enjoyed the practical aspects of herpetology represented by attempts to capture specimens for the Bronx Zoo, but it was one of those specimens that gave me the most exciting time of all. We have two very beautiful and large racers, the Tiger Ratsnake (*Spilotes pul-latus*) and the Blotched Racer (*Dryadophis bifossatus triseriatus*), and it was the latter that gave me such a tough time. A group of children



This South American False Coral Snake came from Bro. Eric's school. It is a good mimic of the true Coral on the preceding page; both have their bands of black arranged in groups of 3.

comparatively cold day and the snake was sluggish.

Our attention had been taken up with the rattler and we had forgotten about the coatis until they started to drop from the tree, one furry ball after another landing with a thud on the soft bush and forest floor. This is not an uncommon occurrence and a whole family will suddenly vacate a tree in this manner. Some of the children had the ready explanation that the coatis had seen us kill the snake and were then free to continue on their way; this continued to be the most popular explanation despite the doubts I expressed. One local man while attempting to catch a coati under similar conditions was knocked flat by one that landed on his neck.

Three types of coral snake have been observed here but the most interesting is the Paraguayan Coral Snake (*Micrurus frontalis*). It has the habit when disturbed of raising its short, tightly

encountered the snake in the middle of a low "camp," and I was called. It took flight and hid in a grass tuft. Poked out of this, it went to a larger clump of grass, which was set afire to drive it out. Finally I caught up with it and attempted to hold it down with the snake stick, whereupon it turned and began chasing me. The snake and I covered an area of several dozen yards in a very short time, I running backward most of the time, and dodging while running, so as to see and avoid the continual lunging strikes of the snake. Eventually we pinned it down long enough to get a noose around it, and it was bagged and put on an airplane bound for New York and the Bronx Zoo the same day. I have never been so persistently chased by any other snake, and subsequent word from Dr. Oliver at the Zoo was that this fiery reptile was as aggressive as ever, striking at anything that came near its compartment.

News from the Conservation Foundation

Investigation of DDT Spraying

Professor John L. George, long a student of the effect of pesticides on wildlife, has been employed by the Conservation Foundation to analyze the reports of all studies heretofore made on the dangers and values of DDT spraying by airplane, allegedly to control insects. Recent widespread airplane spraying conducted by the Department of Agriculture "to control the Gypsy Moth" has resulted in complaints from private property owners that birds, fish, frogs and other wildlife have been killed by poisoning and that various crops have been destroyed. The Department of Agriculture maintains that the quantities of DDT used in the spraying are so small that little or no damage to wildlife should result from the controlled spraying. Following Prof. George's investigation of existing studies relating to this subject, he will prepare recommendations for any further research needed to establish the facts. In the meantime a bill has been introduced in the Congress to appropriate \$280,000 to the U. S. Fish and Wildlife Service for continuing research on the effect of DDT spraying. Dr. Osborn has an appointment with the Director of the U. S. Fish and Wildlife Service and members of his

staff on August 1 to discuss Prof. George's findings and further research proposals.

Alaska Wildlife Film

Extended motion picture footage made by the Olaus and Mardie Murie expedition to the Brooks Range in Alaska last summer is now being edited by our Audio-Visual Department and will be voiced for showing this fall. The expedition recommended the setting aside of a sizable area in the Brooks Range in northeastern Alaska as a Wildlife Refuge.

Conservation in Area Development

Peter Stern attended the Conference of Urban and Rural Planners at New Haven in May, and is currently taking part in the planning of 17 counties in West Virginia for conservation area development as a pilot project. Understanding of the importance of conservation technicians in land-use planning and area development is spreading rapidly since the formation of a committee of industrialists and graduate school administrators, of which Roger Hale is the organizer and secretary.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Honorary Degree from Princeton for Dr. Fairfield Osborn

The honorary degree of Doctor of Science was given to Dr. Fairfield Osborn by Princeton University on June 18. Two years ago he received a similar honor from New York University. The Princeton citation reads:

FAIRFIELD OSBORN — President of the New York Zoological Society and a preserver of the nation's endow-

ment in natural resources, has turned his great energies to account in sensitizing thousands of thinking people to the environmental laws of life. Firm and fighting opponent of all waste and rapacity, he organized, almost single-handed, the Conservation Foundation, and may well be the world's fastest friend of the flowers and forests, birds and beasts, which flourish under his paternal eye between the Atlantic and the Pacific. The country's flora and fauna ought now to award him a scroll inscribed with the fitting title, *Curator Naturae*. Failing that contingency, the Princeton species of *Homo sapiens* takes pleasure today in bestowing upon him the honorary degree of Doctor of Science.

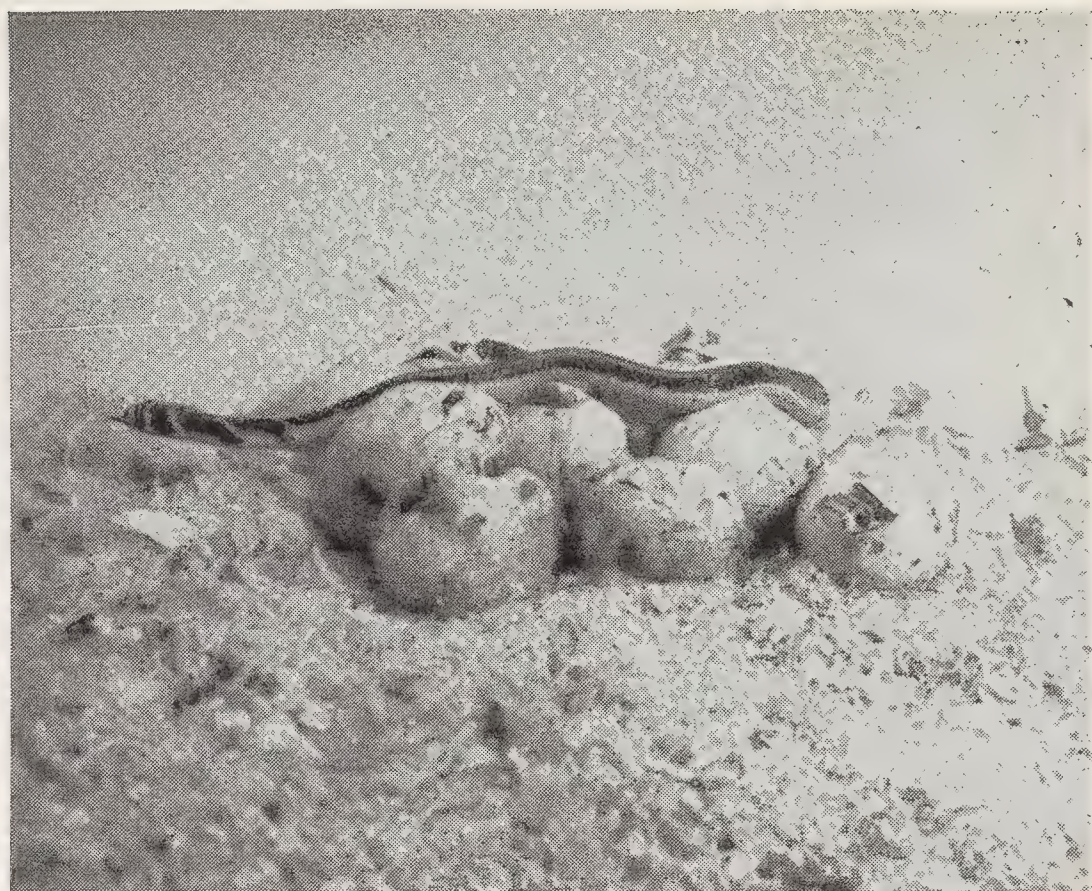
Feeding Baby King Cobras Is Easy (They Say) — You Give Them Milk

By James A. Oliver

OUR KING COBRAS, received in 1953 from Bangkok, Thailand, have been making zoological history ever since 1955 when they became the first of their species to breed in captivity. In that year the female laid 41 eggs from which we hatched 9 healthy young snakes, but we were unable to rear the youngsters. In 1956 the female laid a clutch of 51 eggs, but none of them hatched. On April 24, 1957 — incidentally, the female has laid her eggs on April 24 three years in a row — she laid a new record clutch of 56 eggs. (*Ed. Note:* The label in the Reptile House states that this species lays 20 to 33 eggs. We can't change the label until she stops laying record clutches and we find out what a King Cobra's maximum really is). On July 10, 1957, the first of the eggs began to hatch and by the night of July 14 a total of 39 healthy young snakes had emerged from the eggs — a record brood of King Cobras.

Now the question is: how to raise them. In his press release on this "blessed event," Mr. Bridges pointed out the feeding problem presented by these youngsters. One newspaper printed the story under the headline "Zoo in Cobra Trouble," and it was carried by a news association all over the country. Our problem immediately became a matter of concern to newspaper readers.

Sidewalk superintendents are not limited to any particular kind of human endeavor, but are inevitable wherever a vocal individual watches another in the act of doing or trying to do something. Advice is one thing of which we never have a shortage — even when it comes to raising baby King Cobras. The fact that no human being has ever done so successfully in no way handicaps the "corresponding curators" who *know* how it should be done. Actually this is a commendable, if sometimes annoying, human characteristic and undoubtedly has played an important role in human progress. Occasionally a new or untried idea does come out of the many worthless or already tried suggestions. At least, advice indicates interest and we appreciate that.



First out of the egg . . .

As a result of the press and radio publicity on the baby cobras we have received numerous telephone calls and letters from well-intentioned people. Some have been prompted simply by the desire to be helpful, while others were less disinterested. One of the latter wanted publicity for a book relating the adventures of a snakehunter, and actually cabled a scientist in India requesting advice. The return cable, which was phoned to us, contained nothing we had not tried in 1955.

Most of the phone calls and many of the letters suggested we give them milk — cow's milk — either alone or with other ingredients. One caller stated condescendingly, "Everyone knows Cobras like milk!" If there is any truth to the belief, it means the snakes have acquired their taste for cow's milk in relatively recent times. Where and how do Cobras get cow's milk in the wild? They have not been involved in the legend of the Milk Snake, which is sometimes thought to suck cows dry, but there is a widespread belief in southeastern Asia that Cobras do like milk. According to one version of the story from India one must regularly put out a bowl of milk to keep the neighboring Cobras in a peaceful mood. If this is not done, the snakes get angry and bite someone. Several correspondents state they actually have seen snakes drink milk in low pans put out for cats or dogs. It is quite possible that a thirsty snake would drink milk if water was not available, but that it would do so regularly or in place of eating its normal food seems highly unlikely. One correspondent suggested the modern

twist of using powdered milk, mixed with "the stuff you get under leaf piles, rocks and rotten logs."

One of the letters contains a possible but improbable answer to the question of where the Cobras get milk in the wild. This letter comes from a former French Foreign Legionnaire who saw service in Indo-China. He writes, "We observed quite often the 'junior' Cobras killing a small type of guinea pig with their poisonous bite and sucking the milk out of the breast of the little pig which is always a female. I never saw a baby Cobra killing a male guinea pig."

The oddest of the letters embellishes the milk suggestion by elaborating on other food items. This writer says, "they eat glass, nick china, put away nails and splints of brooms for later on; and shred the edges of a rug with their fangs."

Several of our advisors suggested we get in touch with other institutions or individuals said to have "raised hundreds of them." They are mistaking the smaller Asiatic Cobra (*Naja naja*) for the King Cobra (*Ophiophagus hannah*). To the best of our knowledge no other zoo has ever bred King Cobras and no one has succeeded in rearing them from hatching. A number of zoos, including ours, have bred and reared Asiatic Cobras. In fact, we have three Bronx-bred youngsters that will be two years old this fall.

Now, how do we hope to raise some of our young King Cobras? First, we are dividing them into small groups of one to eight in a cage, each

cage with a different environmental condition. Thus some are in cages with damp moss, some in cages with earth, some on damp sawdust, some in dry cages with a bare floor, some in cages with leaf litter on the floor and some in cages with shredded newspaper. Some are provided with small box shelters and some without; some are in damp cages, some in dry; some are in dark cages and some in light areas.

For food we will offer a wide variety of items. When we hatched nine young in 1955 we offered them more than 30 different foods including young snakes, among which were several species from their native Asia, small lizards, baby mice, worms, insects and insect larvae. The foods were offered dead and alive and some were rubbed with several species of snakes known to be eaten by adult King Cobras. We also force-fed some of the young with solid and liquid foods. This year we will repeat all of these food offerings and will use additional species of snakes, lizards and insects. We will also try small fish of several species. We will try additional variations in the manner of offering the food and in the environmental set-up. We will even offer them milk to make sure we don't pass up any opportunity of rearing the young. However, our real hope of being the first to raise King Cobras successfully lies in the large number of young with which we can work. For this we must thank our splendid adult Cobras and the care given them by the Reptile House Keepers.

First Six Weeks of Aquarium Swamp Its Facilities

What the reaction of the public would be to Stage One of the new Aquarium on the ocean front at Coney Island was the subject of much speculation before dedication of the building on June 5 and the public opening on June 6. The most optimistic guesses failed to equal the reality, however. Between June 6 and July 15, visitors totalled 135,000 in round figures and as the "Coney Island season" advances the attendance at the Aquarium shows no signs of slackening.

On several occasions, particularly on weekends, sale of tickets had to be cancelled for half-hour periods and police had to be called to help control the crowd.

During the summer the Aquarium will be open from 10 A.M. to 10 P.M., every day.

IN BRIEF

Grant for Cancer Research. The Zoological Society has received a grant of \$5,900 from the Damon Runyon Memorial Fund for a research project by Dr. Ross F. Nigrelli, "Anti-cancer Principle from Sea Cucumbers." The grant covers a year's work until April, 1958.

A Record for May. Each spring for several years has set a new record for the number of school children visiting the Zoological Park. This year the total in May was 51,863 children from 1,284 classes and 970 schools.

Miss Crane to Africa. Jocelyn Crane, Assistant Director of the Department of Tropical Research, left on July 24 to continue her studies of fiddler crabs in Africa. Before her return on October 12 she will work on tidal flats and beaches at Mas-sawa, Eritrea; Zanzibar and Pemba Islands; Dar-Es-Salaam, Tanganyika; Lourenco Marques and Inhaca Island, Mozambique; Luanda, Angola; Lagos, Nigeria; and in museums in Cape Town and Paris.

Dr. Beebe Honored. Dr. William Beebe has been made an Honorary Fellow of the Royal Geographical Society of London.

Housekeeping for Butterflies. The August issue of the National Geographic Magazine contains an article by Jocelyn Crane, "Housekeeping for Tropical Butterflies," with extraordinary illustrations in color by M. Woodbridge Williams of the magazine's photographic staff. The pic-

tures were made at the Department of Tropical Research station in Trinidad.

Eggs from Iceland. Eggs shipped from Iceland this spring are now hatching in the Zoo's incubators, and we have a nice collection of young European Eiders, Barrow's Golden-eyes, Black Scoters, Greater Scaup, European Widgeons and Gadwalls.

All Orders on Exhibition. As of mid-July, the Zoological Park for the first time was able to exhibit all zoological Orders of living amphibians and reptiles simultaneously. The rarities are in the Order Rhyncocephalia, which is restricted to the Tuatara, and the Order Apoda, which includes the coecilians, the legless tropical amphibians. We have had a Tuatara for about two years, and recently received a nice collection of coecilians from Sao Tome in the Gulf of Guinea. The remaining six Orders are always on exhibition.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1957)

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John Goelet
Walter M. Jeffords, Jr.
Meyer Stein

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Leighton Coleman
Mrs. William Andrews Clark
Mrs. G. Page Ely
Mrs. Howeth T. Ford
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Mrs. Arthur Gwynne
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Tobias Heller
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Carl O. Kienbusch
Everett Kimmel
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Mrs. Alfred Lee Loomis, Jr.
Leon Magid
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Garry Moore
Herbert Morawetz

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Mrs. Kenneth Wagg
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Reinhold D. Wappler

How Far Away Is a Hammock?

IN THE LAST ISSUE, we volunteered to mail *Animal Kingdom* to members' summer addresses for the benefit of the hammock reader. At the time the offer was made, summer seemed a long way off, hammocks improbable things poised precariously in shady places no one was ever likely to get to.

Summer is now indisputably here and it's clear from the queries drifting in from members that the hammock season is in full swing. For how else and where else could such purely speculative questions as these originate?

Why isn't there a plural of moose?

How about naming Dacca's cubs "Burning" and "Bright"?

Can you train a prairie dog to whistle a tune?

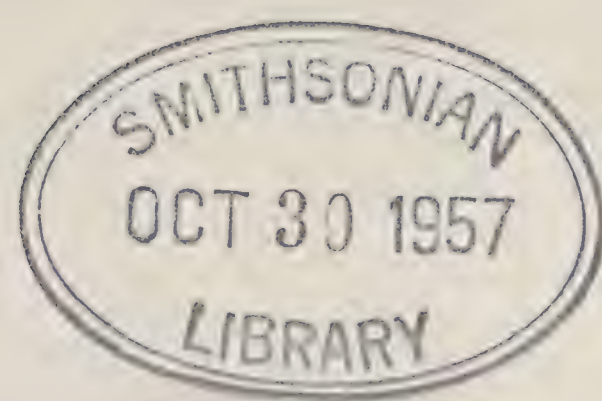
This last question, written hastily on a postcard, disclosed no clue to its sender's identity. A small boy, in uncontested possession of a hammock for a few unmolested moments? A retired professor of Comparative Anatomy? A nature counselor? A — but enough speculation, that perfect hammock occupation.

We can only say we're glad members are getting their *Animal Kingdoms* and thinking the long thoughts. The Zoo's to visit again in the fall, and the prospect of a newsletter from Africa, Members' Saturday morning tours in September and October, and the annual meeting at the Waldorf are far in the future. In the meantime, keep those hammocks swinging, and we'll keep the Zoo humming. We're not too far apart if we think of each other now and then.

MEMBERSHIP DEPARTMENT,
New York Zoological Society,
The Zoological Park,
New York 60, N. Y.



ANIMAL KINGDOM



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ANIMAL KINGDOM

Bulletin of the
New York
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Vol. LX OCTOBER No. 5
1 9 5 7

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The Jackson Hole Biological Research Station

IT IS, OF COURSE, one of the greatest of satisfactions when "just an idea" becomes a successful reality. Some years ago it occurred to us that our Society should supplement the scientific research being done in the tropics at the Field Station in Trinidad by the establishment of a station in a temperate region. The idea flowered and in 1947 the Biological Research Station in Jackson Hole, Wyoming, was established. For six years we administered and financed it during which time it proved itself a valuable center for the study of fauna typical of the extensive mountain regions of the West. (An article elsewhere in this issue describes some of the station's activities). In 1953 we concluded a highly satisfactory arrangement with the University of Wyoming whereby that institution assumed the administration of the Station, the Zoological Society continuing as co-sponsor and helping with grants for selected research projects.

In the meanwhile the land on which the Station was situated became a part of the Grand Teton National Park under Federal jurisdiction. Last year we were somewhat apprehensive that the National Park Service might request the removal of the Station from within the Park boundaries. We were allowed time to attempt to prove that this Station was of essential value to the National Park Service in coping with some of its ecological problems, to say nothing of the Station's evident contributions to the biological sciences.

On September 13th a meeting was held at the headquarters of the Station, attended by the Director and other representatives of the National Park Service, by representatives of the University and by two of our officers — Mr. Laurance Rockefeller and myself. We came to the meeting well schooled in arguments for the continuation of the Station at its present site. We did not need them. Mr. Wirth, Director of the National Park Service, opened the meeting with an enthusiastic endorsement of the work being accomplished by the Research Station, stated that its work was indeed of aid in resolving some of the biological problems with which the National Parks had to cope, and that, finally, the Government would be glad to conclude an arrangement whereby the Station would continue at its present site, thus insuring the long continued activity of this scientific center.

The "idea" of a decade ago has become a tangible and valuable reality.

Fairfield Osborn

OCT 17 1957

50 Years Ago This Fall



THE BISON RETURNED TO

ON MANY A SUMMER DAY in the Eighteen-seventies, a little locomotive with a big smokestack pulled to a stop to take on water and as the passengers stared, a herd of buffalo thundered across the tracks and poured over a rise in the prairie under a cloud of yellow dust.

It is exhilarating just to think about such a sight. But better still, it is exciting to realize that it is possible to *see* such a herd even today, for in the Wichita Mountains of Comanche County, Oklahoma, the great herd founded fifty years ago through the interest of the New York Zoological

Society is thriving under typical plains conditions. Indeed, when a motion picture company recently undertook to recreate the pioneer days of this country, it sent its cameras to the Wichita Mountains Wildlife Refuge to photograph that very herd.

It was 1907 that saw the beginning of the present herd and now in 1957 the American Bison and the State of Oklahoma together celebrate their semi-centennial. The Bison herd and the state have grown up together.

Before there was a Wichita Bison herd and be-



THE PLAINS

By ARTHUR F. HALLORAN

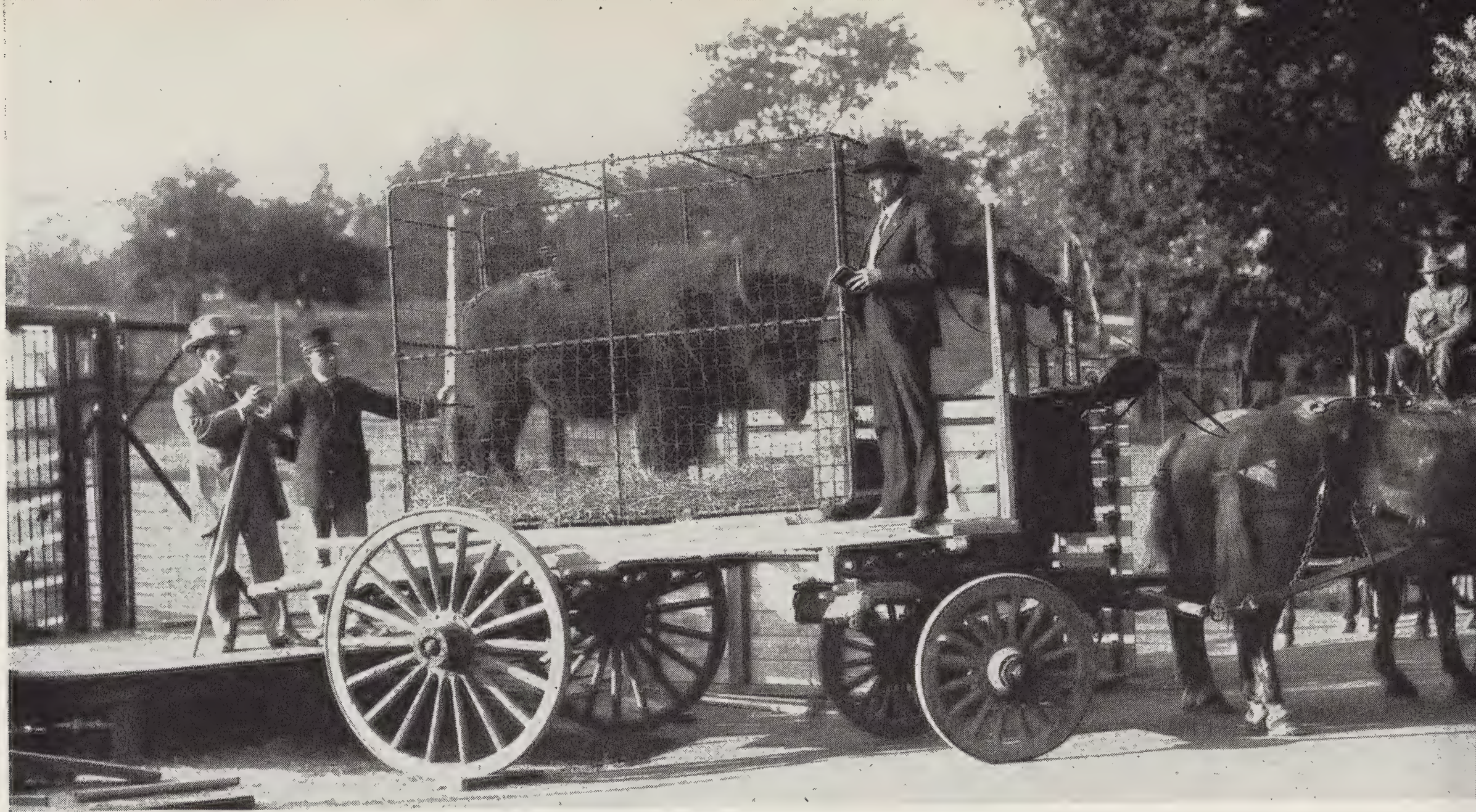
Wildlife Management Biologist, Wichita Mountains Wildlife Refuge

fore Oklahoma was a state, the land was Indian Territory, home of the Kiowas and Comanches. In 1901 Congress set aside a tract within this reservation as a forest reserve of the Department of the Interior, and under a special act of Congress, approved on January 24, 1905, the Wichita became a national game preserve. There have been various administrative changes, but today the 59,000-acre prairie heritage is known as the Wichita Mountains Wildlife Refuge and is under the administration of the Fish and Wildlife Service of the Department of the Interior. For the mo-

ment the Bison herd is safe — but only for the moment. The Army has been trying to take over the southern 10,700 acres of the Refuge and only the protests of conservationists have saved it so far. If the Army succeeds, the present fine herd will have to be reduced.

But that is still undecided, a problem of the immediate future. There were other problems fifty years ago.

At the beginning of this century the vast herds of the earlier days had vanished. Following the great slaughter of the southern herd, even the



Between 11 o'clock on the morning of October 10, 1907, and noon the next day, 15 Bison were put in crates in the Zoo. At the left is Dr. Hornaday; on the wagon, Supt. Frank Rush.

bones were gathered, stacked and shipped away.

When only a few hundred animals were left, conservationists feared that the buffalo might trickle down to nothing and disappear as a species. A few people, however, dreamed of the future and resolved to do something about it. Dr. William T. Hornaday, representing both the New York Zoological Society and the American Bison Society (the latter formed at a meeting in the New York Zoological Park), was foremost among these "dreamers." Pleas for assistance were launched and in 1906 Congress appropriated \$15,000 to fence 8,000 acres of the Wichita buffalo pasture. A wire fence 7½ feet high was completed in 1907.

Dr. Hornaday carefully selected fifteen head of buffalo of various strains from the herd in the New York Zoological Park. Forest Superintendent Frank Rush was appointed to go to New York to supervise the shipment of the seven bulls and eight cows and under his and Dr. Hornaday's direction the animals were loaded in individual crates and hauled by wagon to the railroad.

Two engines were needed to pull the long freight train to St. Louis, but when the animals reached that terminus, traffic was so heavy that the "Frisco Lines" could spare but one engine for the



Two "Arms Palace Horse Cars" were waiting on a siding at Fordham to carry the animals West. In the early evening of October 11, the journey began towards the plains of the West.

rest of the journey. The buffalo were divided and started for the Wichita Mountains a day apart.

Superintendent Rush came in with the first load. Almost fifty years later I had the privilege of talking to Mrs. Rush about the great day when "the buffalo came back to the Wichitas."

Word had spread and it was known to every man, woman and child what day and at what hour the train was due. Long before the arrival time the railroad platform at Cache, Oklahoma, was packed with Indians, cowpunchers and ranch owners. The squaws wore their most colorful blankets; many brought their babies on their backs. Some of the Indians rode into Cache on ponies, others walked, some came in the high-seated, open wagons called "Indian hacks," drawn by two or sometimes four horses or mules. Even Quanah Parker, the famous "Eagle of the Comanches," left his Star House on the southern approaches to Quanah Mountain and was driven to the station by his faithful "Mr. Cable."

Mrs. Rush remembered and could transmit the excitement of the Indians, the older ones es-

pecially. She recalled many of the older men peering into the crates, with young men and boys gathered around them, and telling excited tales of the wild, free days of their own youth when they hunted the buffalo on these very prairies.

It was on October 18, 1907, that the buffalo came back to the Wichitas. It had been a long and tiring journey for the animals and during the winter of 1907-08 they were kept in a corral and were fed and given a chance to rest. The following April they were released into a large pasture to graze the Wichitas as their ancestors had done for thousands of years. This, again, was a day of celebration for the Indians, and two hundred of them gathered to watch the liberation of the herd.

The first calves were born in 1908 when three heifers made their appearance. The herd prospered and grew. More than 3,600 calves have been born up to now and the herd finally became so large that its range was expanded to include all the present 59,000 acres of the Refuge.

Offspring from this herd have been used to stock zoological gardens all over the United States and in several foreign countries. With the exception of four bulls brought in from the Fort Niobrara National Wildlife Refuge in Nebraska, the herd today is made up exclusively of offspring of the original nucleus from the New York Zoological Park. More than 2,000 buffalo have been disposed of, yet there is no dearth of calves — they average 40 a year from each hundred cows, young and old, on the range.

This U. S. Forest Service photograph is undated but the author thinks it was taken on October 18, the day the crated Bison arrived at Cache, Okla., on their way to the Wichita Reserve.





The progress of the herd can perhaps be shown most succinctly by the five-year census figures:

<i>Year</i>	<i>Bison</i>
1907	15
1910	17
1915	52
1920	119
1925	173
1930	247
1935	362
1940	416
1945	544
1950	622
1955	973

Today the buffalo are free to wander as they will, and they roam the prairies in herds of 200 to 300 animals, usually fully visible from the paved or gravelled roads frequented by the visitors (nearly a million a year) who come to the Wichita Mountains Wildlife Refuge on holiday. Each year in November, when the Bison are rounded up, people come from long distances to watch as the calves are cut out of the herd and vaccinated.

Comanche Indians came out from Cache to look at the Bison. During the first winter the animals were kept in small corrals but the next spring they were liberated on the range.

They come in bright and colorful automobiles, not in "Indian hacks" as fifty years ago, but the excitement and interest are still keen. For these are, to all intents and purposes, the wild buffalo of the old days, living as their ancestors did. They feed on wild prairie grasses and forbs the year around — they get no supplements from the government. The result is that the animals are not sluggish, but are quick and active, a thing it is always well to bear in mind. I recall that not long ago a nine-year-old boy, after being "whistled in" to supper at the headquarters area, inadvertently came between a small buffalo calf and its mother. The big cow turned and charged and the boy beat a hasty retreat.

Later, after the buffalo resumed grazing, the boy came in to supper.

"Who's afraid of a buffalo?" he said. "I am!"

Dr. Hornaday's Note of 70 Years Ago Comes to Light in the Smithsonian

DISMANTLING an old Bison exhibit in the Smithsonian Institution in Washington this summer, workmen found a rusty metal box containing two copies of Cosmopolitan magazine dated 1887, and a message written across the top of the first installment of an article by Dr. William T. Hornaday, "The Passing of the Buffalo." The message said:

My Illustrious Successor.
Dear Sir: — Enclosed please find a brief and truthful account of the capture of the specimens which compose this group. The Old Bull, the young cow and the yearling calf were killed by yours truly. When I am dust and ashes I beg you to protect these specimens from deterioration & destruction. Of course they are crude productions in comparison with what you produce, but you must remember that at this time (A.D. 1888. March 7.) the American School of Taxidermy has only just been recognized. Therefore give the devil his due, and revile not —

W. T. HORNADAY

Chief Taxidermist, U. S. National Museum

Dr. Hornaday was Chief Taxidermist for the U. S. National Museum in the 1880's, the first Director of the New York Zoological Park, 1896-1926, and a founder of the American Bison Society in 1907. He died in 1937.

My Illustrious Successor.
Dear Sir: — Enclosed please find a brief and truthful account of the capture of the specimens which compose this group. The Old Bull, the young cow and the yearling calf were killed by yours truly. When I am dust and ashes I beg you to protect these specimens from deterioration & destruction. Of course they are crude productions in comparison with what you produce, but you must remember that at this time (A.D. 1888. March 7.) the American School of Taxidermy has only just been recognized. Therefore give the devil his due, and revile not —
W. T. Hornaday.

THE PASSING OF THE BUFFALO.—I.

BY WILLIAM T. HORNADAY.

Author of "Two Years in the Jungle."

Chief Taxidermist, U. S. National Museum.

AT last the game butchers of the great West have stopped killing buffalo. The buffalo are all dead! The time has now arrived for the Territories to enact stringent laws against the killing of these animals, and I am pleased to see that the Montana Legislature has just rushed through a bill to that effect—only ten years behind its time! Next year, when the last buffalo of the eighty head still alive in the Panhandle of Texas is hunted down and killed, it will be time for the Lone Star State to frame a bill for his protection; but its final passage can hardly be expected until about 1897.

While the Territories are passing laws against the killing of buffalo, they ought also, by all means, to make the killing of mastodons between August 15th and December 1st punishable by a fine or imprisonment. They should also pass laws against the shipping of mastodon carcasses out of their respective territorial limits; for there is such a world of difference between the killing of twenty-six head of game for an Eastern market and the slaughter of that number in one season by one hunter (on Sunday Creek, for instance) to eat, to feed to his dogs, and to let lie in a heap until half of it spoiled.

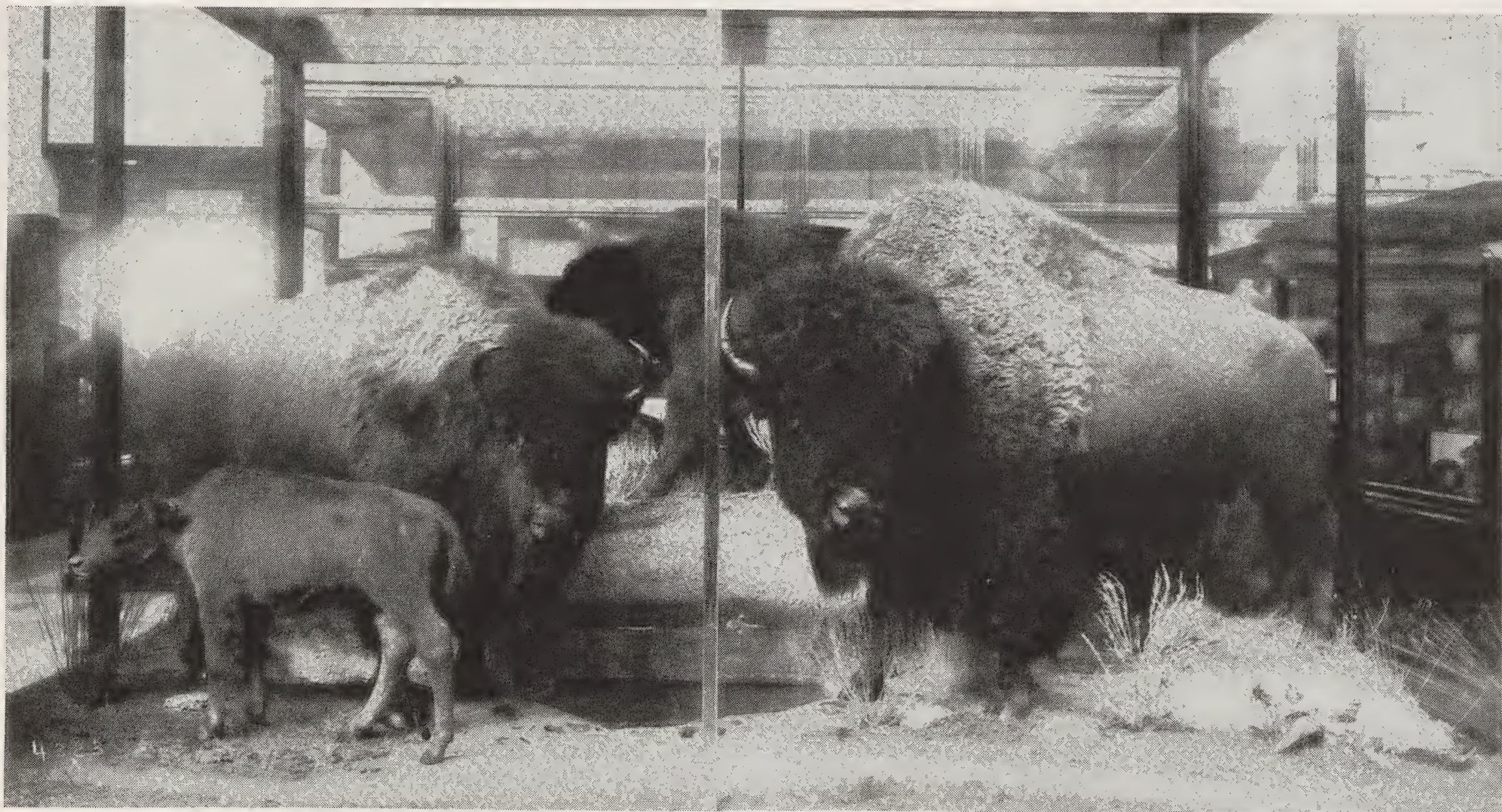
I am really ashamed to confess it, but we have been guilty of killing buffalo in the year of our Lord 1886. Under different circumstances, nothing could have induced me to engage in such a mean, cruel, and utterly heartless enterprise as the hunting down of the last representatives of a vanishing race. But there was no alternative. The Philistines

were upon them, and between leaving them to be killed by the care-for-naught cowboys, who would leave them to decay, body and soul, where they fell, and killing them ourselves for the purpose of preserving their remains, there was really no choice. Perhaps you think a wild animal has no soul; but let me tell you it has. Its skin is its soul, and when mounted by skillful hands, it becomes comparatively immortal.

Now a days it is such an honor to kill a buffalo that whenever a cowboy sees one he chases it, in order to be able to say that he has "chased buffalo;" and if he possibly can, he shoots it to death, in order that he may carry back to his camp five pounds of lean buffalo hump, and have his name go thundering down the ages. It would be an interesting psychological study to determine the exact workings of the mind of a man who is capable of deliberately slaying a noble animal, in the full knowledge that he can make no earthly use of it, but must leave its magnificent skin, its beautiful head, and several hundred pounds of fine flesh to the miserable coyotes and the destroying elements. If such an act is not deliberate murder, in heaven's name, what is it? And yet, there are hundreds of intelligent men who can do such things, and others who can even kill half a dozen tuskless elephants in one forenoon, and call it "sport."

Foreseeing that the great American bison is absolutely certain to be exterminated in a few years, the distinguished Secretary of the Smithsonian Institution determined last

Above: Dr. Hornaday's note. Below: His Bison exhibit in the Smithsonian. It will be preserved.



Common
but Unfamiliar--

LOOKDOWNS AT THE AQUARIUM AGAIN

By JAMES W. ATZ

ONE OF THE ADVANTAGES of locating the new Aquarium on the ocean front is proximity to sea water and marine fishes. While it is unfortunately true that most of the fishes living around New York City cannot compare in beauty or oddity with the inhabitants of tropical seas, especially coral reefs, there are several local species so unusual or attractive in appearance that we try to exhibit them whenever we can. Living on the ocean's doorstep, so to speak, makes it easier for us to obtain such specimens—both by collecting them ourselves and receiving them from neighborly professional and amateur fishermen.

By latest actual count, 130 different species of fishes have been caught in New York harbor, but of these, 40 are rare migrants that are only occasionally seen. About one-third of the remaining 90 species make satisfactory exhibits under present conditions. They include perennial favorites



This is an immature Lookdown. The long streamers on the back and the broad fins arising from the belly almost completely disappear as the fish matures, finally become stubs.

like the seahorses and puffers, as well as peculiar fishes such as sea robins, the Orange Filefish and Spiny Boxfish, which, although common hereabouts, are new and strange to most of our visitors, whether they be New Yorkers or from out of town.

Late summer and early fall is the best collecting time around New York because more kinds of fishes are to be had and because the fishes are better conditioned to live in the Aquarium, the local sea water being nearly as warm as that in our tanks. Already, in our first season of local marine collecting in 16 years (except for an occasional Killie hunt), we have obtained a number of good exhibition fish.

Among them, some young Lookdowns have proved outstanding. These small, strangely-shaped fish never fail to attract attention as they sail sedately about their tank. They are so greatly flattened from side to side that they sometimes appear paper-thin, and this, in addition to their angular profile and smooth skin of silver washed with gold, gives the illusion of finely chased ornaments rather than living fish.

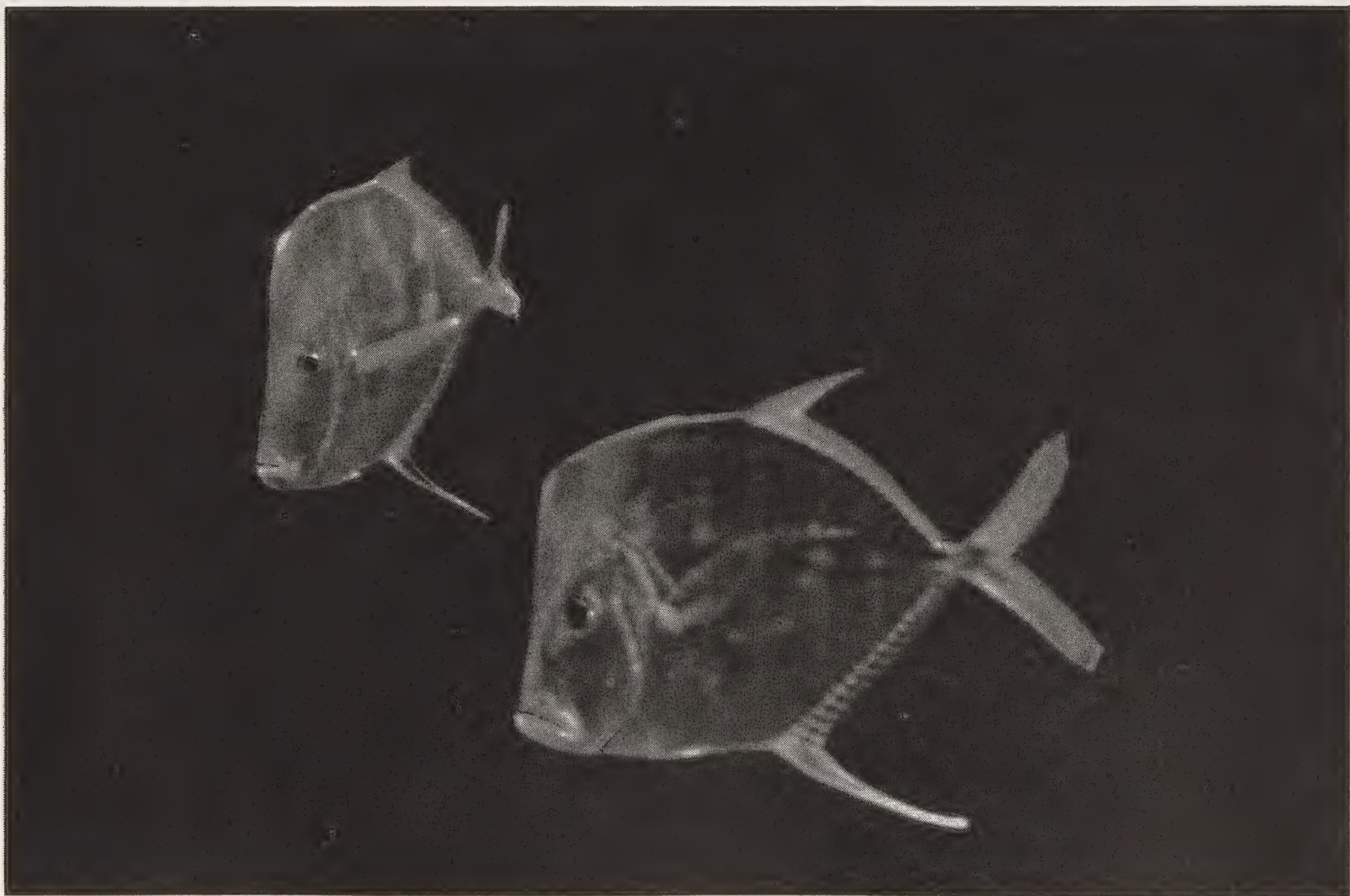
Our specimens are approximately three inches in total length, while adults grow to be about a foot long. During growth, the Lookdown's fins undergo some remarkable changes. The large, dusky paired fins attached to the belly (called pelvics or ventrals) practically disappear, only a stub remaining. The long graceful streamers arising from the anterior end of the fin on the back (the dorsal) are also lost, again only a tiny triangular bit being left. At the same time these fins are regressing, two others are growing. A small portion of the middle of the dorsal develops into a sweeping falcate extension, and another outgrowth, which is almost a mirror-image of the one above it, appears at the anterior end of the unpaired belly fin (the anal).

The significance of these striking modifications

is a mystery. So little is known about the life history of the Lookdown that we can make no comparisons between its mode of life as a juvenile and as an adult. Perhaps the changes are associated with a life spent in more open waters, which seems to be the home of larger Lookdowns. This species belongs to the group of jacks (Family Carangidae) which includes several famous food and game fishes, such as the Florida Pompano and the California Yellowtail. We know that at least a few other members of the Family change their fins radically as they grow older. For example, the Threadfish, which carries streamers three or more times as long as its body, eventually loses them and turns into a rather ordinary looking jack.

That we do not understand the Lookdown and its peculiar growing up does not prevent us from appreciating it. As several young skin divers have already found out, the presentation of a live Lookdown at our door is as good as a free pass to the Aquarium.

Except for the general shape of the body, the mature Lookdown bears little resemblance to its young self. Here the long, sweeping fins have gone. We do not know their purpose.





Ten Years of Biology in the Mountains

By GORDON CUYLER

BUT I KNOW they're good to eat," the young woman had said. "In Sweden I gather mushrooms all the time. Look — I'll cook them myself."

"Not in my kitchen you won't," the chef had retorted. "This isn't Sweden and maybe they're toadstools. You get an OK from Dr. Solheim over there at the Research Station and I'll cook 'em for you. But not unless he says OK."

So that was why Dr. W. G. Solheim was half an hour late that morning in starting his day's collecting of aquatic plants in Jackson Hole's Swan Lake. For he not only identified the "toad-

stools" (they were proper mushrooms, all right, and perfectly good to eat) but he took the time to escort his Swedish visitor through the herbarium of the Jackson Hole Biological Research Station and make sure she knew as much about mycology as she thought she did.

And that, I thought as I watched the incident, in a small way shows how the Research Station has become a part of the life of Jackson Hole. A dozen times a day somebody on the research staff is sure to be consulted as the final authority on some point of natural history. And invariably the answer is given with scientific exactitude and

completeness and, most important of all, with neighborly willingness.

I have just come back from Jackson Hole and this is a report on what has been happening to the Research Station that the New York Zoological Society quietly founded out there in the summer of 1947. Like good seed, the Station has prospered beyond the fondest hopes of its founders, and Members of the Society can feel a special pride in the part their support has played in its development.

Before visiting the Station for the first time, I had boned up on the 89 research projects accomplished since its birth. A formidable list covering, so it seemed to me, every conceivable aspect of the area's flora and fauna. Every mammal, from the tiny Uinta, universally known as the picket pin because of its habit of sitting up rigidly straight, if only for a fraction of a second, to that greatest of big game animals, the Moose, had been classified, studied and reported on. Nor had the birds, reptiles, fishes, amphibians, grasses,

Any time they tire of their research projects, investigators at the Jackson Hole Biological Research Station can refresh themselves by this scene of Jackson Lake lying under Mr. Moran.

Photo by Pennsylvania State College

Investigators discuss their projects and problems at weekly seminars — always informal sessions which local people like to attend. The speaker here is Dr. Beetle; he works on sagebrush.

Photo by Gerald Scherba

flowers, sagebrush and many other forms of life been neglected, for one of the group's prime purposes is to study the whole ecological picture and that can only be done by getting a thorough understanding of its component parts.

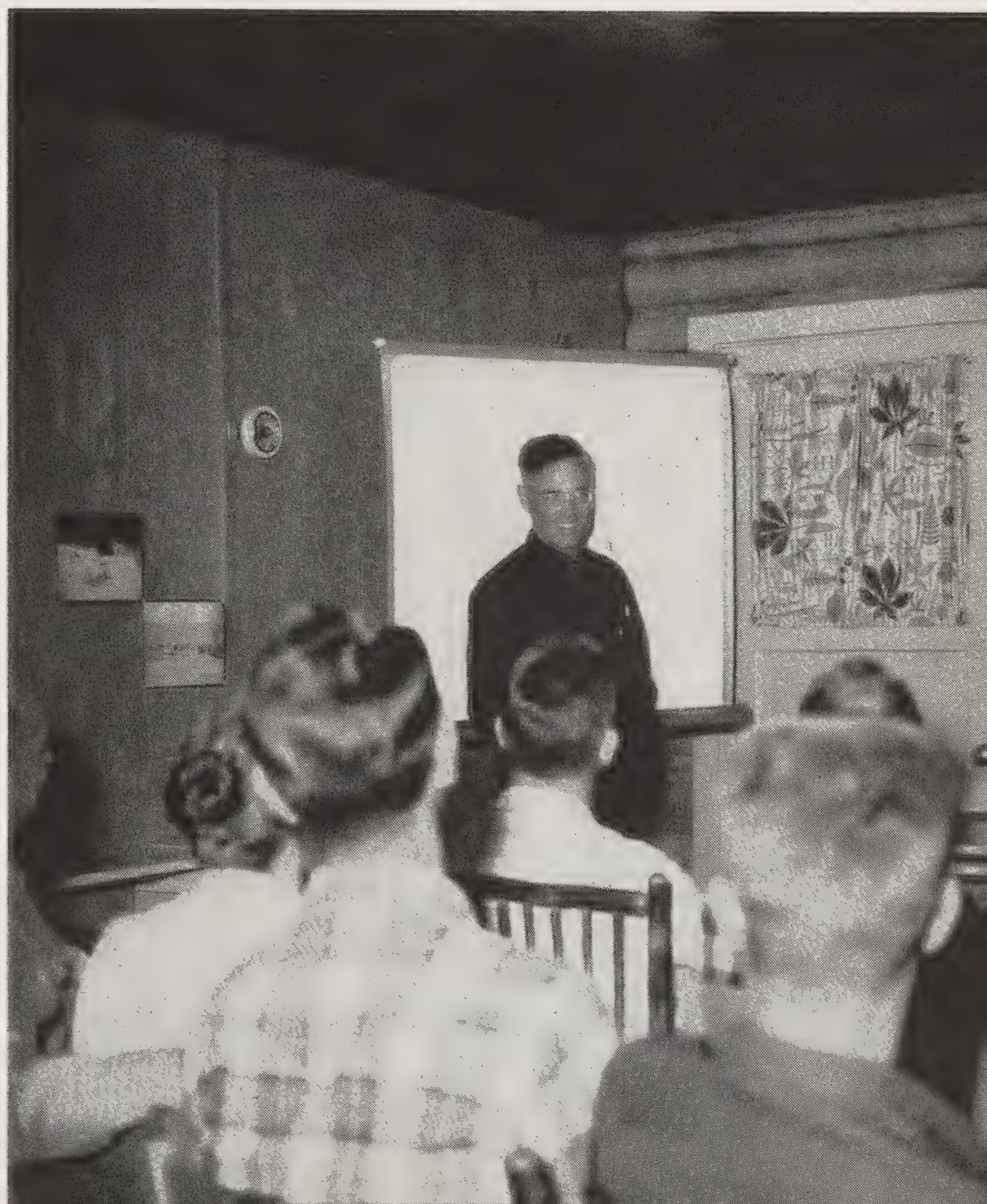
One of the chief reasons for establishing a research outpost in Jackson Hole was to give the Zoological Society an opportunity to support field work in two sharply-contrasting environments: in the tropics and sub-tropics as at the Department of Tropical Research Station in Trinidad and in the temperate and mountainous zone at Jackson

Hole. As far as I know, no other zoological institution has this possibility.

The impression created by the Station on first sight was friendly and casual and I was soon to find that the people in it were equally out-going and unprofessorial.

The first person I wanted to see was Dr. L. Floyd Clarke, Director of the Station since 1953 for the University of Wyoming. It turned out that he was on the roof of a building that he had somehow or other contrived — he never would tell me just how — to have moved to the grounds. As he put the finishing touches on an intricate electrical wiring job, I recollected a story about Dr. William Beebe when he was engaging a young biologist to go on one of his expeditions. "All right," Dr. Beebe was heard to say, "You seem to be a proper biologist and all that. But what I want to know is—can you get a stalled Ford truck going again in a rainstorm?" The way the Chairman of Wyoming's Department of Zoology and Physiology soldered those wires together was eloquent evidence that he was the kind of field biologist Dr. Beebe would approve.

It soon became apparent, as Dr. Clarke took me on a tour of the station, that while its buildings may be simple, its operational problems are a little more complex. For one thing, there is never enough field equipment such as trucks,



Johnson motors and boats to go around, and Dr. Clarke has to decide who gets what and when. Even before we started on our tour, he was called on to straighten out a typically tangled situation: Could Dr. Margaret Altmann take the horse trailer for a week's field trip to study pre-rutting behavior of Moose? The trailer's absence might seriously interfere with other projects, and besides it's never a good idea in a field station to let equipment get tied up for any length of time; someone else is sure to want it. Dr. Clarke talked the thing over with the other investigators who might need it, telephoned another associate and got clearance from him, and then helped Dr. Altmann make the hitch tight to the back of her car. I had the feeling from the way he handled this one that his faculties of judgment get plenty of exercise.

Dr. Clarke told me a little about the investigators and their projects in Jackson Hole this summer. Although he deprecated his influence on the specific studies, it was obvious, when I later talked to the field people themselves, that his imaginative insight had guided them in taking advantage of the unique possibilities of the region.

It was he, for example, who took Dr. Gerald Scherba to Moose Island, showed him the thou-

sands of huge ant mounds there, and suggested a study of dynamic population problems. One day, when he himself had been able to get the Station's boat, he had chug-chugged Dr. Kenneth John all over Two Ocean Lake (so named long ago in the mistaken belief that the lake lay on the Continental Divide and emptied its waters into both the Atlantic and the Pacific) and talked over with him a genetic study of the crooked-back chub tolerated there by the native fish population. If the genetic background of the deformed chub can be determined, information about harmful mutations may be developed that is badly needed in this age of atomic radiation.

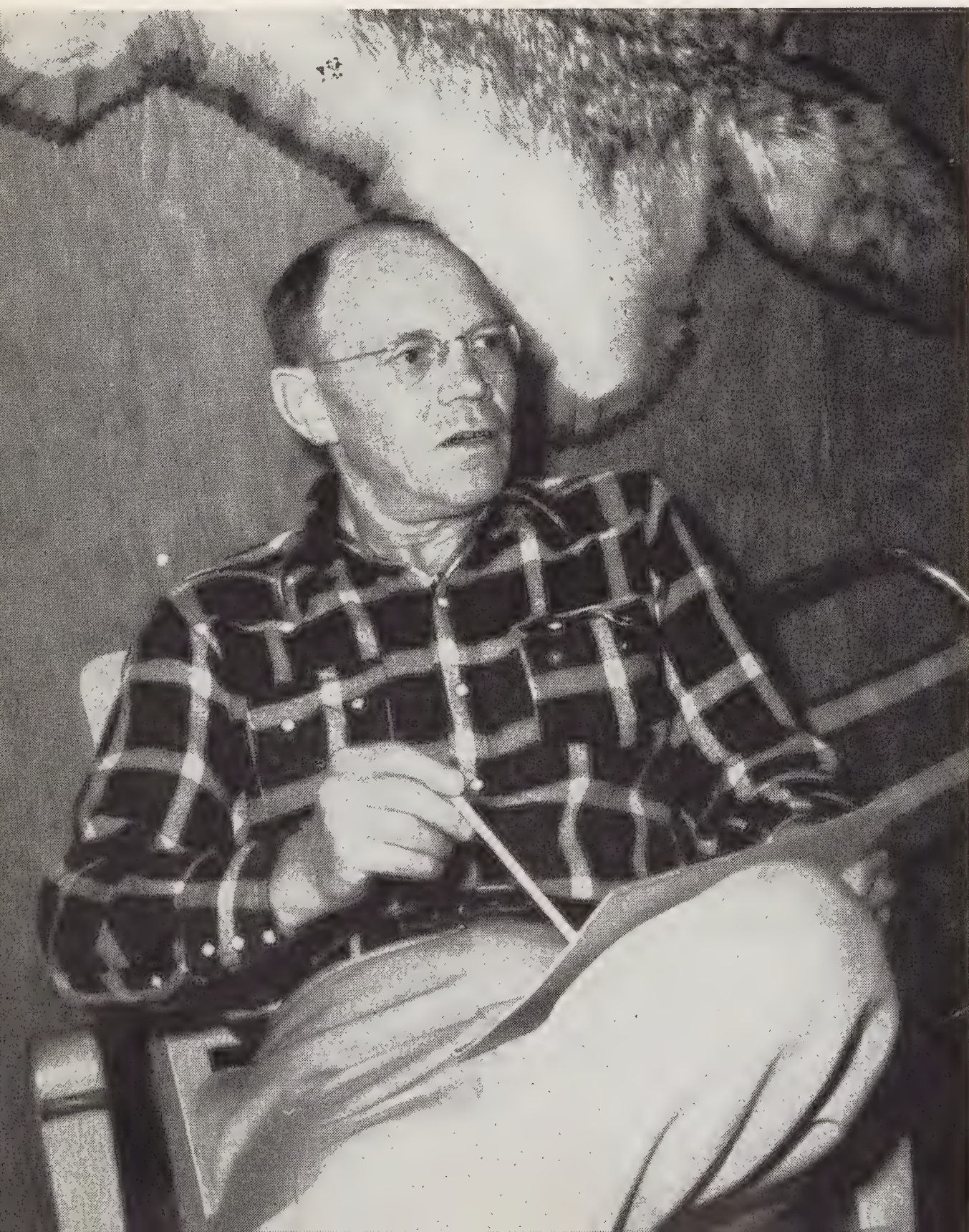
The best way to become quickly acquainted with the Station's interests is to attend one of the weekly evening seminars when one of the investigators talks, as informally as carpet slippers, about the things he has been doing. The living room of Dr. Clarke's cabin is the "lecture room" and the audience may sit on comfortable western chairs or (more likely if there is a biggish crowd) cross-legged on the floor. There are seldom fewer than thirty or forty men and women at these seminars, whatever the subject, for the Station people come as a matter of course to talk shop and there has been a steady build-up of visiting

In his capacity as Director of the Station, Dr. L. Floyd Clarke keeps a score of research projects going. He has the scientific insight to make full use of the resources of the region.

Photo by Gerald Scherba

Park Rangers, foresters, range managers and naturalists, artists and photographers who happen to be staying at the Lodge a short distance away. Anything and everything in the way of natural history is likely to be talked about.

At the blackboard the night I attended a seminar was Dr. Kenneth Armitage, known to his colleagues as "Marmotage" because of his absorbed interest in the Yellow-bellied Marmot. He has been studying a colony of marmots for the past three summers and as he threaded his way through the complexities of marmot life and charted their failures and successes in the struggle for life, I made a mental note that if ever the Zoological Park undertakes to exhibit a colony of marmots, "Marmotage" Armitage is the man who should be called in to advise us.



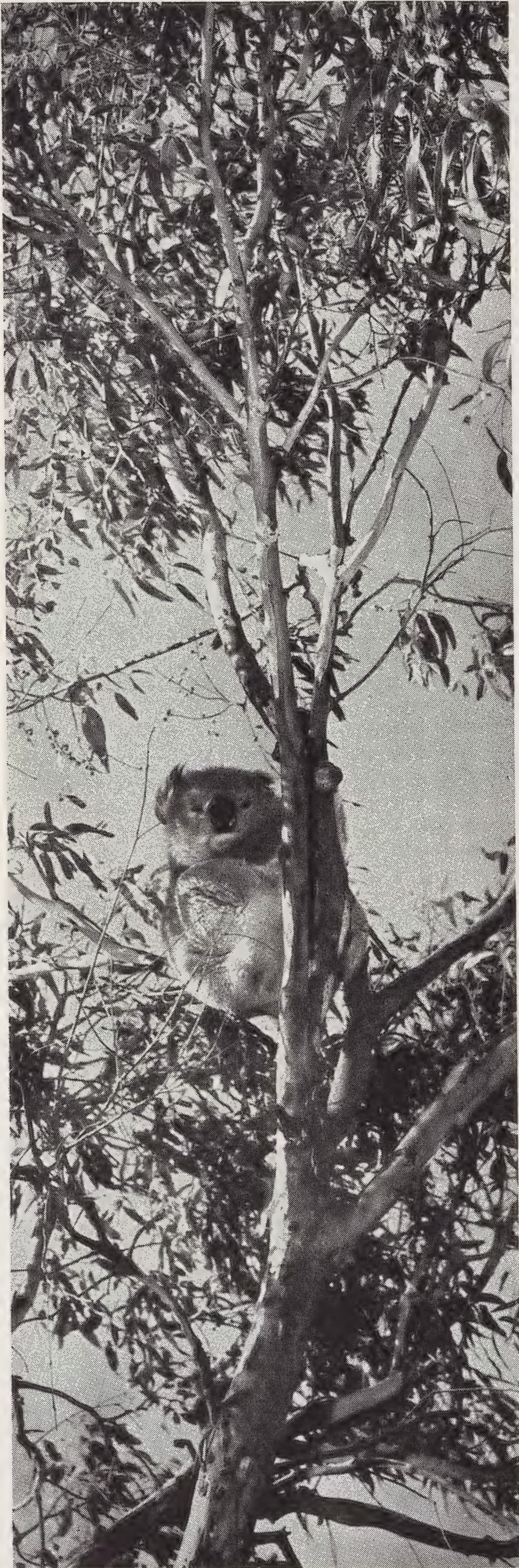


The role of adviser and consultant is considered by Dr. Clarke and his associates as a fundamental obligation of the station to the Jackson Hole community. They make it a point, for example, to take an active part in the conferences and open meetings held from time to time under the sponsorship of the Departments of the Interior and Agriculture. This last summer the resident researchers undertook to give weekly talks to student Park Rangers at Ramshorn Ranch. The value of these sessions cannot yet be assessed, but it is obvious that talks by such experts as Dr. Alan Beetle on range management, Dr. Ralph Honess on animal parasites, Dr. Garth Kennington on the influence of altitude on animal metabolism and Dr. Charles Thornton on the amphibia's ability to regenerate tissues, cannot fail to be of very great benefit to the young students who will one day be responsible for our national parks and forests.

The morning after the seminar I went over to Swan Lake with Dr. Clarke and his assistant, Brad House. Drs. Clarke, Solheim and George

Dr. Margaret Altmann, studying the behavior of Moose, is often away from the Station for many days at a time. She pitches camp wherever the movements of the animals take her.

Baxter are making a limnological study of the lake, a project of practical importance right now because the area has attracted an increasing number of tourists and their effect on the phytoplankton and zooplankton of the lake must be carefully calculated if the lake is to remain unchanged. With his blue jeans rolled up and a battered felt hat, studded with fishing flies, shoved to the back of his head, the Director of the Station seemed an entirely different man from the urbane chairman of the session of the night before. In the classroom at night, in the lake the next morning. A nice balance of the theoretical and the practical, and a measure of the line the Jackson Hole Biological Research Station has been following for ten years. The Zoological Society can be well satisfied with the way its experiment has turned out.



Koala Roundup in Australia

*Photographs and information supplied by
Australian News and Information Bureau.
Photographs taken by Neil Murray*

IN THE PAST THIRTY YEARS some 5,500 Koalas have been captured by the Fisheries and Game Department of Australia and transferred from areas of dwindling food supplies to new homes among lush stands of eucalyptus. The pictures on this and the next few pages are scenes during the latest roundup in which some 200 Koalas were captured on Phillip Island, off the coast of Southern Australia, and taken to the mainland for resettlement.

There are about 350 identified varieties of eucalyptus and Koalas prefer only five of them — the manna, red gum, spotted gum, yellow box and tallow wood. Once settled in a tree, they strip it of leaves and then move to another. As a result, the tree dies, dries out, and eventually forest fires sweep through and destroy both dead and living trees, as well as many Koalas.



Phillip Island had a population of about 350 Koalas and the number of eucalyptus trees was so reduced that the island would support only about 150 animals. Capturing for resettlement elsewhere was comparatively easy with the new technique put into effect in the current roundup. A noose, so tied that it cannot tighten to the chok-

ing point, is lifted at the end of a long pole and gently dropped over the Koala's head. The habitual position of the animal as it clings to a tree, head well out from the trunk, facilitates noosing, and when the tree is low enough, a slow-moving Koala can be noosed and dislodged in a matter of a few minutes.



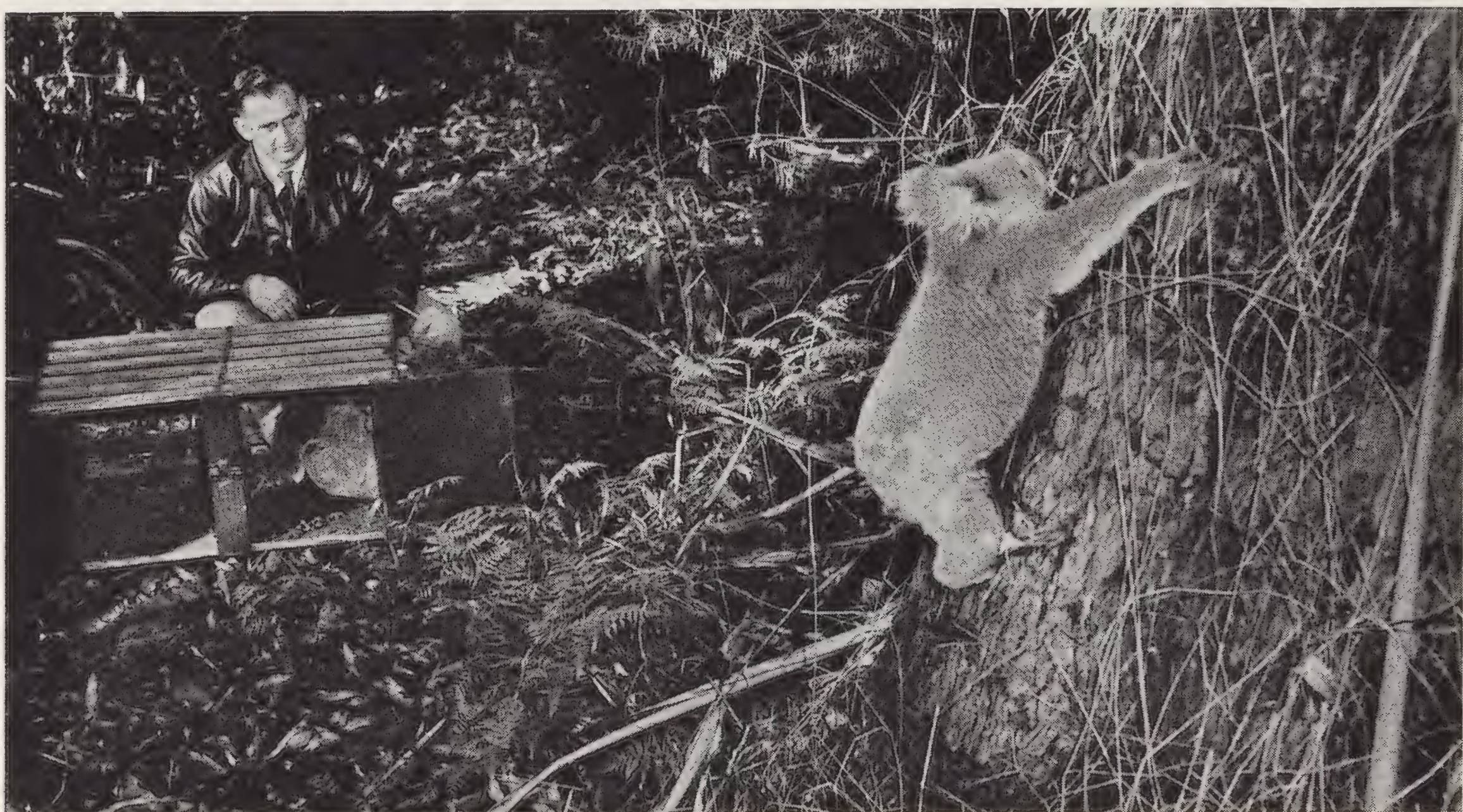
Down he comes! Underneath the tree, assistants wait with an outstretched safety sheet, the kind used by firemen, and the Koala lands unharmed. In earlier roundups, the game wardens had to climb the trees, creep as close as they could to a wary Koala, and then lasso it and drag it to the ground where helpers grabbed it with long

tweezers with wide-curving ends that enfolded the furry body. Routinely the Koalas were weighed and measured before being put into a crate for shipment to the mainland. The largest specimen captured on Phillip Island this year weighed 33 pounds. Koalas are said to eat about 2½ pounds of foliage a day.



This year's roundup on Phillip Island was something of a race against time, as it had to be completed before new shoots appeared on the eucalyptus tree, many of which were partially burned in recent forest fires. The new shoots, unlike the later foliage, contain a volatile poison that may bring slow paralysis or even death to animals eating them. Apparently when there are plenty of leaves, Koalas avoid the new shoots. But fires and over-feeding had reduced the food supply on the island to such an extent that it was feared the new tips would be eaten out of necessity. The population in Phillip Island will, of course, slowly build up over the years and probably another roundup will have to be made eventually. Koalas breed every two years as a rule, are full grown at four years and may live to an age of twenty years. The "gum baby" remains in its mother's pouch, out of sight for about the first six months. It continues to use the pouch for another two months, and after that time is carried on the mother's back.





In the photograph at the top of this page, the last of the Koalas has just been released from its shipping crate and is looking around for a tree to climb in the Watts River Reserve near the Sir Colin MacKenzie Sanctuary at Healesville, Victoria. The 200 animals from Phillip Island were taken to four new home-sites — to the Watts River

valley, to Buchan in East Gippsland, to Hanging Rock Reserve near Woodend and to Hall's Gap in the Grampian Mountains. Here there is a plentiful supply of the right kind of eucalypts and it is hoped that they will flourish, for Australians of all ages love the little animal. It is, of course, strictly protected.



Ellis Troughton of the Australian Museum in Sydney summed up the case for the Koala in his "Furred Animals of Australia."

"The fascinating koala is utterly harmless everywhere," he wrote. "What a keen delight for all if they were plentiful enough to haunt the homesteads and suburbs as possum often do! May

their numbers miraculously increase to browse peacefully in sheltered forest reserves, together with many others of our fascinating zoological heritage from the past, under perpetual protection which Australia owes to them."

That was written in 1943, and it seems likely that his wish will come to pass.

Kingfishers Are "Problem Birds"

By WILLIAM G. CONWAY

MOMENTARILY ABANDONING its typical upright pose, an eight-inch, blue-backed, white-headed kingfisher wipes its bill vigorously against a limb as two Samoan boys pause in their evening stroll along the beach to watch. Perhaps at the same instant on the outskirts of an awakening Ethiopian village another blue-backed kingfisher — this one green-crowned instead of white-headed — utters its harsh cry. In the Bronx Zoo it is still night and four brilliant little kingfishers from Java, well-adjusted newcomers, are sleeping soundly, stirring only as the night watchman makes his rounds.

Halfway around the world there are always White-collared Kingfishers going about their busy lives, from the coast of Ethiopia along the coast of India and through the Indo-Australian Archipelago as far east as Samoa. For there are more than forty subspecies of *Halcyon chloris*, and many of them are so strikingly different in color and pattern that no single description of their appearance — or even their habits — can cover them all.

Originally, we may suppose, there was a central point of distribution and all the kingfishers that we now know as various forms of the White-collared Kingfisher were very much alike. But so different are they in appearance now, and so widespread, that they give us an interesting picture of one stage in the evolution of new species from isolated segments.

For example, in the Micronesian Islands, Saipan and Tinian, we find a form known as *albicilla* that is all white below and on the head but blue on its back and wings and tail. Over in the Solomon Islands, on Rennel, we encounter a smaller subspecies named *amoena* that is blue-backed, but has a rufous collar and eye-stripe. Both forms are considered variants of the White-

collared Kingfisher which have arisen through the isolation imposed by widely separated islands. Systematists think that the much smaller sacred kingfishers and flat-billed kingfishers of the South Pacific are probably "terminal links" in the White-collared Kingfisher group's chain of evolution. If it were possible for two islands supporting two divergent races of the group to be pushed together, we might suspect that their populations would eventually merge and become indistinguishable, unless some other isolating mechanism had developed, such as difference in courtship or ecological niche. If these last possibilities occurred, we might then, of course, change our arbitrary designation of subspecies to full species for each of two islands' kingfishers. Our own Veery, Gray-cheeked, Olive-backed and Hermit Thrushes are good examples of closely related full species living within the same areas but not interbreeding because of behavior and ecological fencing mechanisms.

Our four White-collared Kingfishers here in the Zoological Park are *Halcyon chloris palmeri* (Oberholser), a subspecies which ranges through Java and Bali. Their habits might seem strange to bird students familiar with our native Belted Kingfisher. The White-collared is a tree kingfisher, belonging to a group which subsists mainly on insects and small animals rather than fish such as the Belted Kingfisher prefers. While our Belted Kingfisher excavates a long nest burrow (preferably in a raw clay, sand or gravelly bank), the tree kingfishers dig or utilize tree hollows. The White-collared digs a nest cavity in a decaying tree or in a nest of tree termites much after the fashion of barbets and woodpeckers. In 1889, Wallace pointed out, "When both sexes are brilliant or conspicuous, the nest is such as to con-

ceal the sitting bird; but when the male is brightly colored and the female sits exposed on the nest, she is always less brilliant and generally of quite sober and protective hues." While we may think of some near exceptions, kingfishers fall into the "conspicuous" group and nest well concealed in holes, as do practically all of their relatives: motmots, hoopoes, bee-eaters, rollers, hornbills, etc.

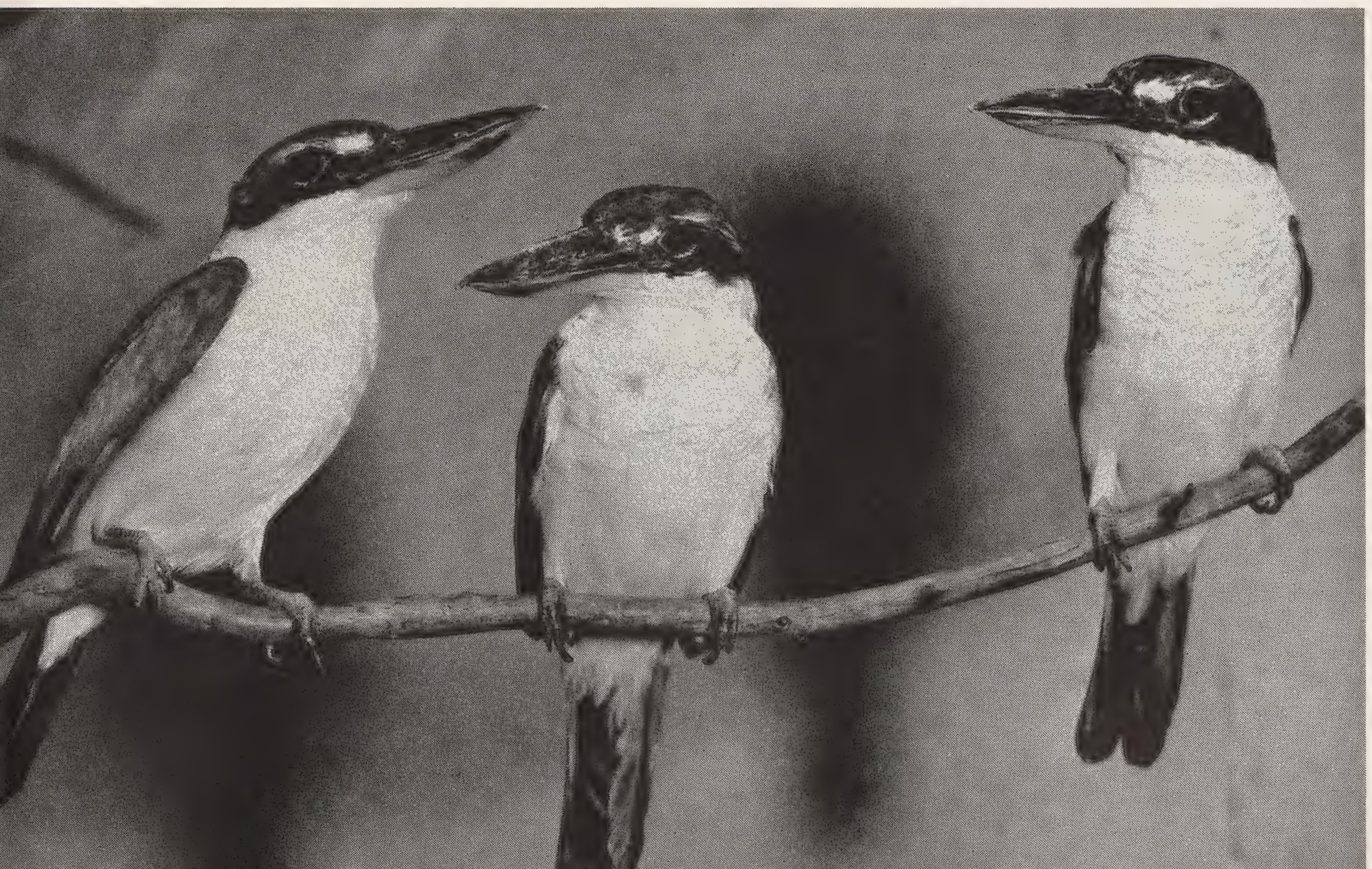
Both sexes of the White-collared Kingfisher are brightly colored but in those races with buff or rufous in the plumage the males tend to show more on the eye-stripe, collar and flanks than the female. Unfortunately, our birds belong to one of the races with no buff or rufous, and so, with wisdom born of many embarrassments, we will refrain from publishing our guess on the sexes of these specimens. Determining sex is a good deal simpler in the local Belted Kingfisher, for the female is distinguished from the male by the presence of an abdominal "belt" of reddish feathers, one of the few instances among birds in which the female is more colorful than the male.

It may seem surprising, but the White-collared is only the fifth species or subspecies of kingfisher we have exhibited in almost sixty years, whereas our records show no less than 96 species and subspecies of hummingbirds, which are notorious for their delicacy. There are several reasons for this apparent paradox. Hummingbirds are usually far more abundant, at least locally, in their ranges. Kingfishers are not only less abundant

in species, but most forms tend to be solitary in habits, hard to catch and apparently very territorially-minded. More important, the great majority of hummingbirds are very easily taught to accept a liquid substitute food for their wild diet of nectar and insects. Not so the kingfisher. While it would appear that tree kingfishers, with their comparatively varied diet, are more easily taught to accept substitute foods than "water" kingfishers such as our Belted Kingfisher, both present problems.

Teaching a wild-caught bird to eat substitute foods is called the "breaking off" process. Fortunately the normal behavior of some problem feeders may be utilized to change their habits. An example is certain warblers which will not feed readily when newly captured, but which will drink. The trick is to keep them warm and dry and gradually to add insectile food to their drinking water. In a little while the warbler is drinking a soup, then a mash, and finally eating our normal moist insectivorous mixture. Or difficult woodpeckers may be confined in a small darkened cage with one hole as a light source. Over this hole a thin slice of tomato or apple is placed, backed with a suitable food mix, and covered

Three of the four little White-collared Kingfishers recently received in the Zoological Park are companionable, but the fourth is seldom allowed to settle on the limb with them.



with a glass jar. In an attempt to peck his way out to the light, the woodpecker usually discovers his barrier is good to eat. Thus the first step in recognition of substitute foods is taken.

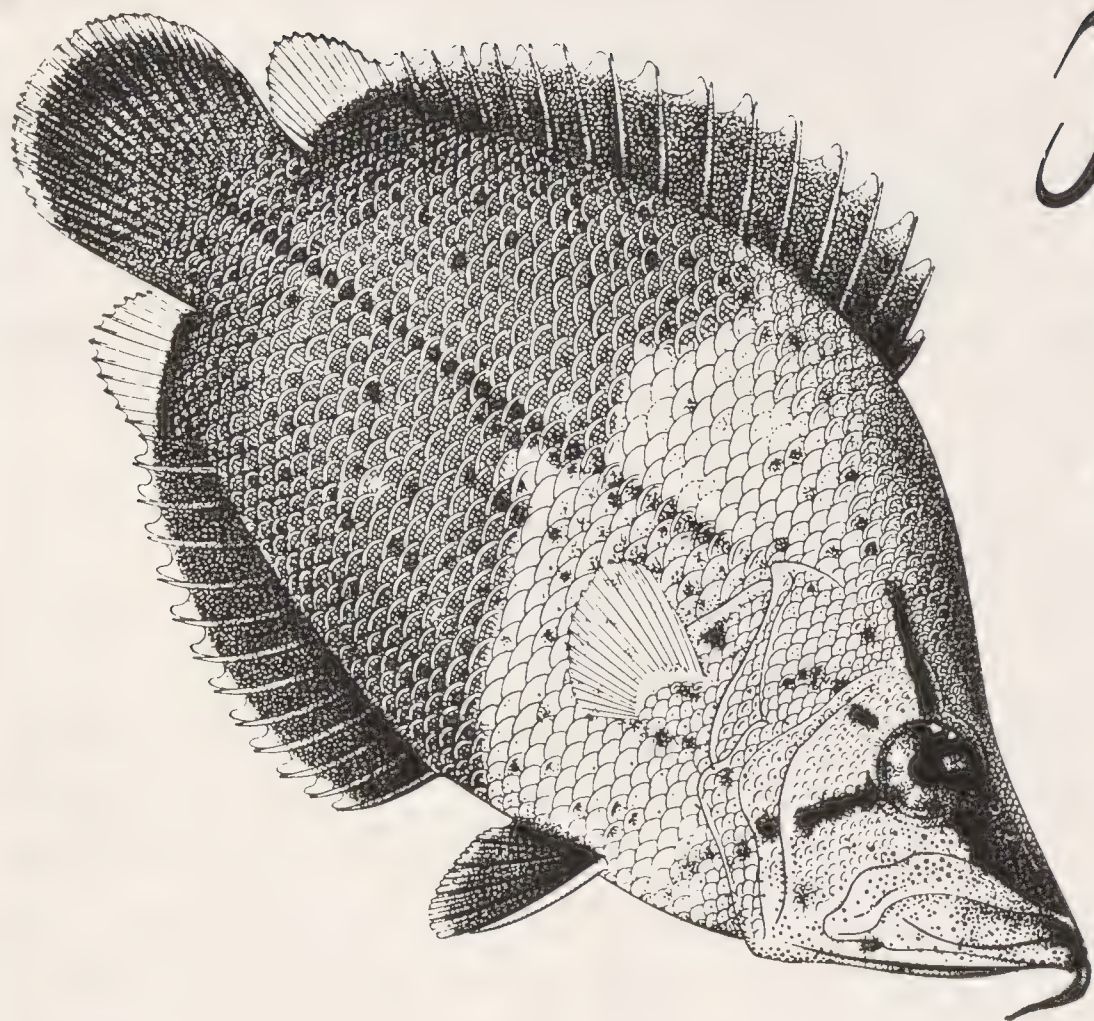
Realizing how many birds eventually thrive on wholly unnatural foods, it is sometimes hard to appreciate the problem a bird is confronted with in the recognition of new food under unnatural conditions. But when we remember that our woodpecker and kingfisher, to mention two, are operating largely through a set of behavior patterns developed over a long evolutionary time, and that they are adapted, perhaps, to chop a grub from a stump or plunge upon a shadowy fish in a stream, it is amazing that specialized forms ever learn to accept the quite different-looking mixtures which must form the basis of most practical captive diets.

With even the most subtle ruses or drastic measures, adult water-haunting kingfishers such as our Belted rarely learn to eat in captivity. Even live fish, in a restricted enclosure where the kingfisher can not hover and plunge in its accustomed fashion, usually fail to evoke feeding in wild-caught adults. On the other hand, nestling "water" kingfishers may learn to feed on substitute foods with considerable success. Incidentally, like hawks and owls and many other birds, kingfishers regurgitate pellets consisting of indigestible scales, pieces of insect chitin and bones of their food creatures.

Our White-collared Kingfishers presented a feeding problem from the first day of their arrival. While Malayan and Pacific reference books listed the bird as a primarily insectivorous "characteristic tree kingfisher," our African sources referred to the subspecies in their area as a crustacean and insect eater, and commented that their race is "said not to eat fish by choice." Australian authors completed the circle with the statement that their forms fed upon small fish and crustaceans. While it might be that the food preferences of the races vary greatly, it appeared that our four new birds were "characteristic tree kingfishers," primarily insectivorous, fond of small lizards, feeding upon crustaceans and fish — or something! The dusky edgings of their white breast feathers indicated that they were immature, and it was a logical supposition that they had been captured as nestlings. We knew that

en route from Java they had been fed strips of meat in a pan of water, and that they "killed" the meat by beating it against their perches in a manner typical of kingfishers the world over. While such a regimen is satisfactory for a short period, it is not the sort of diet with which we might hope to establish longevity records. For the meat we substituted fish and our standard mixture for insectivorous birds — and both were disdained. Well, there is more than one way to gain a point. Anxious to take advantage of the nutritional value of fish, we switched back to meat strips in water, and then gradually replaced them with an increasing number of fish strips. This trick worked and some fish became part of the birds' diet. At this point we weighed the birds (72.2 g., 71.9 g., 67.8 g., and 61.9 g.) as a record and indication of condition and placed them on display. Two Golden-backed Woodpeckers, a Pheasant-tailed Jacana, and two Wattled Starlings were added to the exhibit. As we had hoped, our kingfishers were soon eating the insectile mix in addition to fish and meat, perhaps inspired by the examples of their mates. Actually, however, it is a matter of conjecture whether these birds will or will not learn by example. In any event, from our observations of the White-collared Kingfisher's rapid unmaneuverable flight, its food preferences and general behavior, we are inclined to doubt that it often attempts the fly-catcher-like sallies for flying insects which many typical tree kingfishers make, and we are inclined to guess that our subspecies may well eat fish.

The Polynesians and other Pacific Island peoples have long incorporated kingfishers in their beliefs. Undoubtedly the White-collared Kingfisher has a place in their legends. Closer to home is the folklore of the European species, *Alcedo atthis*. Medieval legend would have it that the kingfisher was originally a drab gray bird. When it was liberated from Noah's Ark, it flew toward the distant sun and its back assumed the hue of the sky above it while its breast was scorched to rufous color by the heat of the sun. A dried kingfisher's body kept in a closet was said to protect woollens from moths. It is supposed to divert thunderbolts, too. If anyone wants to make anything of it, we could add that during a fierce electrical storm in July, lightning struck in the Zoo. It hit a tree *beside* the Main Bird House.



The Drifting Leaf that Is a Fish

From Eigenmann & Allen, Biological Bulletin, Vol. 41, No. 5, 1921. Drawing by W. S. Atkinson. 1½ x life-sized.

By MYRON GORDON

WHEN WILLIAM R. ALLEN, an ichthyologist of the University of Kentucky, was collecting fishes in the Amazon in 1920 for a scientific survey of the South American fishes which he and Carl H. Eigenmann of Indiana University were making, he was told of a strange fish that lived a seemingly drifting life in the sluggish waters of Peruvian jungles. The savages, Allen said, called the fish *Pira-caa*, which means "a small fish that looks like a leaf," or in short, a *leaffish*. Allen was also told that, although the strange fish was a voracious predator and capable of catching and eating other fish its own size, it appeared to be as innocuous as a water-logged leaf.

Allen's Indians poisoned a stream and the ichthyologist later wrote about it in "A Leaf-mimicking Fish" in the *Biological Bulletin* in 1921.

"In order to know if there was sufficient current to carry the poison to every part of the pool, I began tossing broken twigs on the water to observe their course with the current. One such twig had reached a standstill, when directly beneath it I saw what was apparently a dead leaf being wafted past the twig. I couldn't understand why the twig was not moving too. At about that moment the leaf moved out into a path of sunlight, and toward the surface. There the re-

semblance to a fish became apparent, especially to one in search of the same."

Allen was not the first to discover the leaffish in South America. Back in 1840 Ernst Heckel, the famous German zoologist, gave it its generic name *Monocirrhus* after studying some Amazonian specimens sent to him from the Ríos Negro and Cupai. Sporadically some live leaf-fish were sent to German aquarists in the early part of 1900, probably from the Essequibo River of British Guiana. They certainly live there because George S. Myers of Stanford University said that he caught some there during the second World War. After 1921, importations of the leaffish for aquarium use became more frequent but they did not cause any unusual excitement until Wm. T. Innes in 1933 publicized them by printing two remarkable pictures in his then new magazine, *The Aquarium*. These pictures firmly established the leaffish as one of the attractive novelties in the aquarium world, especially for those aquarists who had or could raise a superabundance of guppies to feed them.

In an aquarium the thin, flat *Monocirrhus* carries on its usual imitation of things that are plant-like; the fish's coloring and black markings add to its success in the art of camouflage. If at any particular moment its body coloring does not



The Leafish at the upper right has its mouth almost closed, in the normal water-breathing position. But it can be opened enormously to form a membranous tunnel, as in the other fish.

Photograph by William T. Innes

Here a Leafish is guarding and aerating the eggs, which may be seen on the under side of the horizontal leaf. Vibration of the fish's small pectoral fin creates a slow-moving current of water.

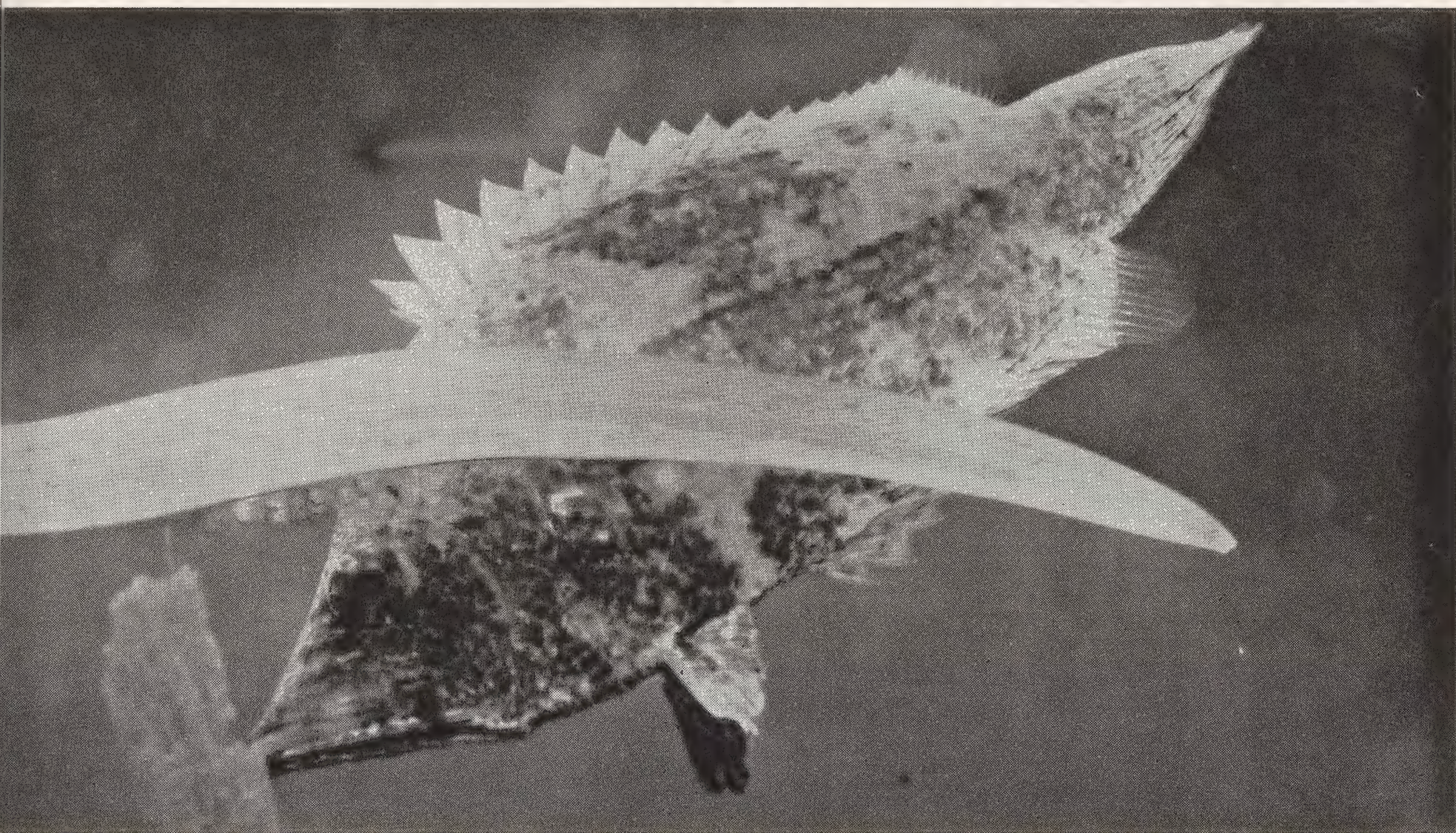
match its surroundings the leafish, like a quick-change actor on the stage, can alter its appearance to suit an appropriate scene. If an aquarium plant is greenish-brown, the fish will become greenish-brown too. Several inquisitive aquarists have tested the limits of the fish's ability to mimic its surroundings. When they placed in the aquarium a long-dead, water-logged leaf blotched by the decomposing action of fungi and bacteria, the leafish soon matched every aspect of it, blotches and all.

The fish's head-down posture, with its goatee-like fleshy pendant, adds to its likeness to a submerged and buoyant leaf and stem. One aquarist, in a humorous mood, referred to the fish's fleshy tab of tissue on its lower jaw as a "beard" and casually remarked that it might be a male trait. Later, another aquarist took this seriously and got into an argument about it, saying that if the chin tab was a "beard" then he could prove that his "bearded lady" fish laid a batch of eggs. Actually both sexes may or may not have a goatee of skin. They sometimes lose them in a battle, for they are occasionally bitten by other larger fishes and they will fight among themselves. The leafish's scientific name *Monocirrhus* refers to this single, fleshy, tendril-like goatee.

When the time for mating comes along, it is

the male leafish that selects and prepares the spawning site. It may choose the underside of a large aquatic plant, such as a *Cryptocoryne* or a broad-leaved *Echinodorus*, a slab of slate or a flower pot. Lacking all of these conveniences one leafish chose a vertical angle formed at the corner of the aquarium. By some subtle body movements the male courts the female and induces it to come to his side. Together they engage in a sort of prespawning dance in which their bodies shimmy rhythmically and their coordinated vibrations are punctuated by tail waggings and slappings. At the peak of their mutually stimulating contacts the pair turn upside down, the female oviposits one egg at a time — each egg, being adhesive, is firmly secured to the under surface of a plant or of a suitable artifact — and the ova are immediately fertilized by the male. About a hundred eggs are expelled, and each fertilized egg is clear, spherical and about one millimeter in diameter. When spawning is over in an aquarium the female, seemingly by prearrangement, retires to a neutral corner. If the pair had spawned in their natural water, she would probably wander off.

In the early days some aquarists thought that the female rather than the male cared for the eggs, but the error has been attributed to the diffi-



culty of sexing the fish accurately, at least until the time of their spawning. The male leaffish usually takes on the job of guarding the spawning areas and aerating the developing eggs; this he does by placing his flat body, tail up, head down, as close to the spawn as possible and then by rapidly vibrating his small pectoral fin. This creates an effective current of water that passes over the eggs. Intruders entering the spawning area are driven away by a threatening display which is unexpectedly vigorous in a fish whose movements are usually quite slow and rather deliberate.

At a water temperature of 78° F. the eggs are likely to hatch in two or three days — but hatching does not immediately give the fry complete freedom, for they are tied to their nesting site by almost invisible threads. Perhaps this simple but effective device has evolved as an advantageous structure to prevent the helpless fry from sinking into the suffocating mud. It certainly facilitates their father's job in guarding them at one central spot against their many enemies. The system is not fool-proof. Sometimes in the course of his duties the male may accidentally get his body so close to the spawn that he buffets his tethered young offspring free of their moorings. This does no harm to the detached fry when they are in a

clean-bottomed aquarium and in a few days all are capable of moving about under their own power. The young fish soon learn to swim about in that lazy drifting manner of their parents, stopping dead still from time to time, waiting, watching, for the approach of a tiny crustacean such as a daphnia or newly hatched brine shrimp nauplii.

When they reach half an inch, the blunt-headed leaffish will stalk and capture baby guppies. Part of the young leaffish's body is dark and part is translucent, giving the fish at this early age the great advantage of camouflage. To the naked eye each fish seems ragged, like a bit of a torn leaf, but parts of their fins are really not torn at all but merely transparent. It is quite difficult to spot the leaffish when they are against a background of floating and submerged broken vegetation because in addition to their imitative, leaflike outlines, their bodies are finely dusted with white dots which add to their protective coloration.

While the small leaffish eat all sorts of smaller aquatic game in the form of worms and crustaceans, the mature fish are generally piscivorous. In nature they hunt and capture live fish, but the aquarist Don L. Jacobs trained them to eat dead ones. First he held small live fish in front of the



These two Leaffish babies were photographed under a microscope soon after hatching. Large dark spots on the head are developing eyes.

young "leafers" with his fingers; then he hand-fed them on freshly killed fish. Later, he substituted and taught them to take frozen fish (after, of course, these were well thawed out and reached the temperature of the aquarium water). This ingenious aquarist found frozen Dixie mosquito-fish a most convenient food for leafers and other fish like them. Jacobs could always get a good supply of these *Gambusia* in the quiet waterways in Georgia, and would deep freeze them until wanted.

Wm. T. Innes obtained his first leaffish in 1933 and he immediately set about photographing them. He was about to trigger the shutter of his camera when one of the leaffish opened its mouth and "yawned a mile long." He snapped it and got a remarkable picture. Its mouth seemed to unfold deep from within itself and, when fully opened, it formed an enormous membranous oval tunnel. It seemed unbelievable that all this large and intricate apparatus, consisting of multiple membranes and bony supports, could have been so beautifully collapsed and completely hidden from view. When at rest its mouth was as neatly folded as a closed umbrella. The purpose of the leaffish's cavernous mouth seemed inexplicable to Innes. He guessed that the fish used it, when in a vertical position, to dig for living food in the bottom mud of the water by-ways of Brazil's Río Negro. But later Jacobs watched the trigger action of its mouth when the leaffish was about to swallow an unsuspecting member of its

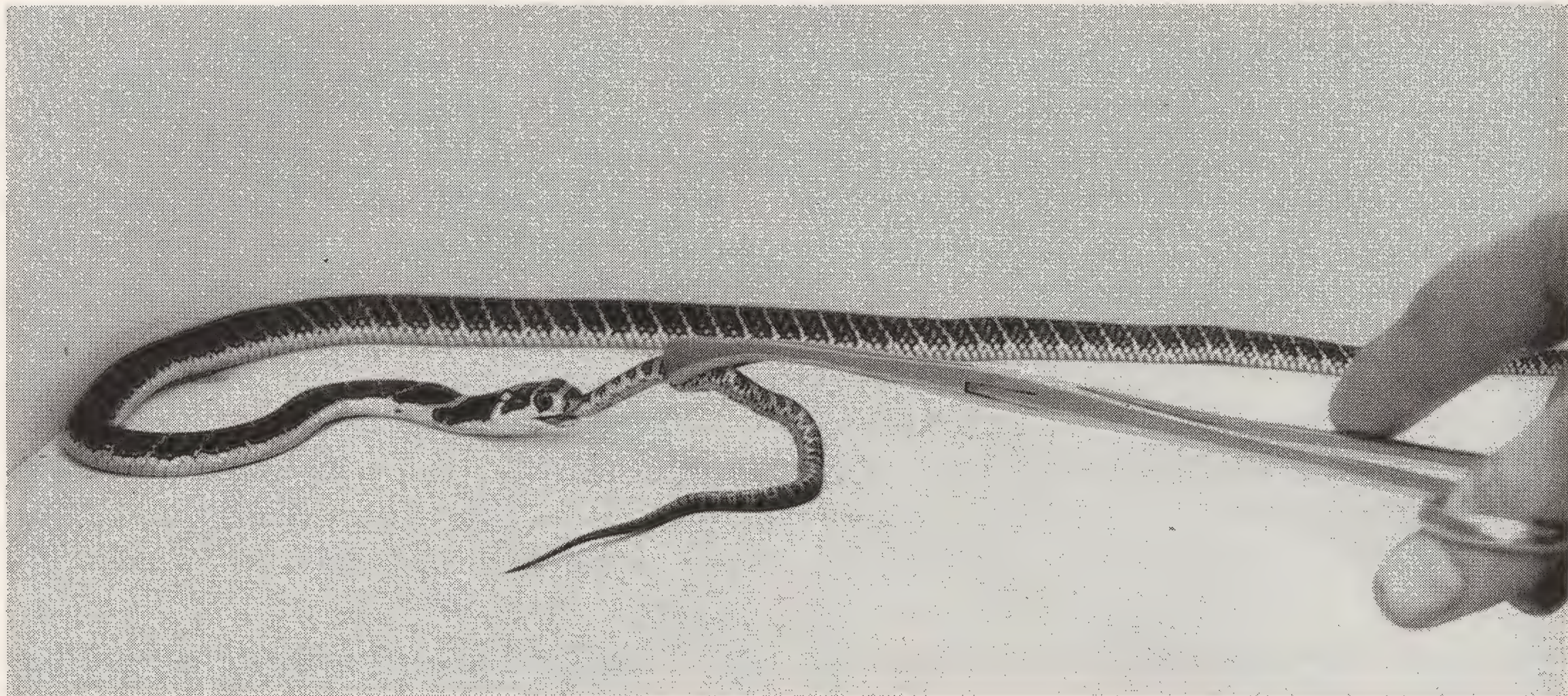
community. The sudden opening of its enormous tubular mouth, he said, created a vacuum within its gullet, so strong that a fish an inch away and seemingly safe was instantly and violently sucked into its wide, gaping mouth. All this was done without noticeable body movement on the part of the leaffish.

C. W. Coates, Director of the New York Aquarium, often has had occasion to warn aquarists that the leaffish is *not* a community fish. It will swallow several large guppies without effort and eat a two-inch swordtail with possibly a trifle more zest. On one occasion Don Jacobs fed his *Monocirrhus* on more live top-minnows than the leafers could take at one helping. They gorged themselves within a few minutes, right up to the limit of their short gastro-intestinal system. The small fish swam about with impunity, but the animated plant-like fish could not swallow another victim. Later, when the effects of gluttony wore off, the smaller fish became quite wary and were difficult to approach; some of the *Gambusia* swam close to the surface where the leaffish in their stilted and inverted position could not easily follow. This stalemate did not last long. One hungry leafer, Jacobs noticed, drifted to the surface, twisted its flat body to parallel that of the surface of the water and then, when it was floating half in and half out of the water, it moved imperceptibly toward its victim, keeping its mouth below the water. Suddenly its gaping mouth flew open and vacuumed a *Gambusia* into its gullet.

Separated by the wide Atlantic Ocean, the American leaffish has an old zoological family relative in Africa. In a way, the American *Monocirrhus* and the African *Polycentropis* look somewhat alike and have the same general breeding habits. It is one of the mysteries of nature how these two leaffishes got separated by miles of sea. Zoologists, through their study of comparative anatomy, have found additional members of the Family Nantidae to which these two leaffishes belong. And the mystery deepens because the other species, though few in number, live in India, Asia and some of the East Indian islands. The peculiar geographical distribution of the Nantidae has been used by some naturalists as one of their strongest arguments for the theory of the drifting apart of the continents during the geological history of the world.

Now We Know

HOW TO FEED BABY KING COBRAS



By JAMES A. OLIVER

IN THE LAST ISSUE of *Animal Kingdom* we reported the hatching of 39 King Cobras and described the difficulties we expected in getting them to feed. Our worries are now over! Most, and perhaps all by this date, are eating regularly — a tribute to the constant and watchful care given by the Reptile Keepers.

Still-born Garter Snakes are the answer — or part of it — and we found this solution by the merest accident.

The Cobras hatched between July 10 and 14 and for the first two weeks we made little attempt to feed them, for in the beginning they are nourished by residual egg yolk. We did offer a few items from time to time just in case any of them were beginning to have an urge to eat. At the appropriate time, however, we began a systematic offering of every kind of food they *ought* to eat. The menu we planned for them included all the items we had offered unsuccessfully to our nine King Cobra hatchlings in 1955, plus a few others

One of the baby King Cobras is bold enough — or voracious enough — to take food direct from the forceps when it is offered. Here it is beginning to swallow a dead Garter Snake.

that imagination suggested. We made a special point of giving them all a chance to drink milk, not because we thought they would but because so many persons had insisted that cobras drink milk that we wanted to settle the matter once and for all. The babies did swim through the dishes of milk and their tails whipped up a little froth, but not once did they make a meal of it. In one cage when we deprived them of water and put only milk in the cage, one or two drank a little of the milk but this was merely taken in place of water and not as food. When both milk and water were present in a cage the milk was not tasted.

When the babies were 13 to 17 days old, depending on their hatching dates, they had been offered and had rejected ten of the thirty-some-odd kinds of food we planned to give them. They

had had a good selection from the menu of worms, fish, salamanders, frogs, snakes, mice and meat we were prepared to provide, and nothing pleased them.

A short time before, Head Keeper of Birds Joseph Bell and former Reptile Keeper Robert Raabe, now in the Bird Department, had captured a 35-inch female Garter Snake in the wilderness on the east side of the Zoological Park, and at the very end of July she gave birth to 23 young, eight of them still-born.

Ordinarily there is not much use the Reptile Department can make of still-born Garter Snakes. But since snakes had a high priority on the little cobras' menu — adult King Cobras feed almost entirely on snakes — Head Keeper of Reptiles Steve Spencook thought there could be no harm in giving the cobras a chance to reject this offering, too. He placed the dead Garter Snakes in several of the cages.

At this time the cobras were being kept under six different conditions of dryness and dampness, light and dark, and with different media covering the floors of the cages. Almost immediately the still-born Garter Snakes placed in the two dark cages were consumed. Those in the light cages were not touched.

Here was a clue, but where did it lead? Freshly killed Garter Snakes had been refused previously in all cages. Now they were offered again, and again refused, while the still-born ones were consumed. How could we get enough still-born Garter Snakes to keep 39 young King Cobras filled up?

We were still pondering this problem when the Reptile Keepers reported three freshly killed

Garter Snakes had been accepted in three of the other cages. That began to take the pressure off somewhat — but we weren't feeding them fast enough to prevent four of the young cobras from disappearing. They had simply been swallowed by their cagemates. Obviously the youngsters were hungry and now willing to eat — also our colony had been reduced to 35.

In the two weeks following the first voluntary feeding, 48 small dead snakes were eaten. All of these were Garter Snakes except four, three De-Kay's Snakes and one Water Snake eaten by the best feeder of them all, a relatively large cobra that now takes its food from forceps held by the keepers.

Thirty-five young King Cobras are more than we have room for. Consequently we wrote to colleagues in other zoological parks and offered them the opportunity of trying their hands at cobra rearing. We have now sent young to the zoos in Staten Island, Philadelphia, Washington, Pittsburgh and Buffalo. Ten we have kept for ourselves. At least some of those sent elsewhere are known to be feeding, and all of ours are good feeders.

Now we have a few facts about the rearing of King Cobras. The ones that ate first were in groups of six, and were kept in darkness. They were 13 to 17 days old when they began to feed, and they showed a definite preference for still-born over freshly killed or live Garter Snakes. From still-born Garter Snakes they quickly went on to freshly killed Garter Snakes. Next year, if our breeding pair produces another brood for us, we will approach the feeding problem with a great deal more confidence than we had this year.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

THE DUCK-BILLED PLATYPUSES

An End—and a Beginning Again?

By WILLIAM BRIDGES

NEWSPAPERS AND THE RADIO must have carried to most of the United States the news that we no longer have Duck-billed Platypuses in our collection; on August 1 Penelope was found to have escaped from the Platypusary, and on September 18 Cecil was found dead in one of his hay-filled tunnels. No trace of Penelope was ever discovered, and the most painstaking autopsy failed to reveal the cause of Cecil's death.

It is safe to say that no animals in the history of the New York Zoological Park approached these queer little Australian mammals in the intense, immediate and continued interest they excited in the American public. When David Fleay brought them to New York on April 25, 1947, visitors formed double lines hundreds of feet long every afternoon to spend a few minutes staring at the furry little "Duck-bills" paddling in their swimming pool. Extra attendants had to be stationed at the Platypusary to urge the visitors—in whispers, for the Platypuses resented sudden loud noises—to "Move along and let the rest see them." In recent years public curiosity had declined somewhat, but it took an enormous leap forward late this summer after Penelope disappeared under mysterious and perhaps romantic circumstances, and again lines of visitors waited for a chance to see Cecil, the ardent suitor whose unwelcome attentions were more than half suspected of driving Penelope to escape from a supposedly Platypus-proof enclosure.

After Penelope disappeared, letters and telephone calls reported her in a dozen distant and unlikely places—one of them 150 miles from New York. Although staff and keepers scanned ponds in the Zoological Park and the banks of the Bronx River that runs through the Zoo, and

kept the search up night and day for several weeks, no trace of her was ever found. If she *did* reach the Bronx River she would presumably find plenty of crayfish and worms to eat, but it is doubtful if she could survive a New York winter. All hope of finding her has been abandoned.

We can almost hazard a guess that Cecil starved himself to death, although that simplification leaves unanswered the question of why he gradually ceased to eat. When he was taken indoors in November, 1956, he weighed 3.806 pounds, which is normally plump. On May 22, 1957, when he was put on exhibition out of doors, he weighed 3.41 pounds—again, a normal over-winter drop. But at the routine weighing on August 13 of this year, he was down to 3.036 pounds—and a little more than a month later, at the time of his death, he was a lean 2.31 pounds. Since August 10 he had fed erratically, sometimes taking as few as ten of the 35 to 40 crayfish he usually consumed in a night. He did, however, continue to eat about a pound of earthworms and a portion of coddled egg each night.

Cecil lived with us 10 years, 4 months and 24 days, and Penelope just 49 days less. Both set new records for longevity in continuous captivity. The qualification "continuous" must be made because Mr. Fleay, the Australian "Platypus man," had a Platypus named Jack in his possession for all but five or six weeks of fourteen years. After eight years in continuous captivity with Mr. Fleay, Jack was returned to the wild, but a few weeks later Mr. Fleay captured a male which he was positive was Jack, and which lived another six years with him. No one who knows Mr. Fleay will question his recognition and identification of his friend Jack, who, while under Mr. Fleay's



A female South African Ostrich on the African Plains exhibit has recently learned that it is possible to take a bath in the Waterhole. Ostriches thoroughly enjoy a shower bath from a hose.

care, had been the father of the first baby Platypus hatched in captivity. Not even in the Australian zoological gardens have longevity records approaching those of Cecil and Penelope been established.

Shall we try again? The question was answered in the affirmative on the afternoon of the day Cecil was found dead, at a conference of President Osborn and Director Tee-Van. Dr. Osborn has made formal application on behalf of the Zoological Society to the Australian Prime Minister and other government departments for permission to have three juvenile Platypuses—a male and two females—collected for us. The animals are strictly protected but they seem not to be excessively rare—Mr. Fleay captured 19 in three weeks' hunting in 1946—and we hope that our success in keeping Cecil and Penelope for more than ten years will tell in our favor and incline the authorities to grant our request.

Sir Edward Hallstrom, the President of the Taronga Zoological Park Trust in Sydney, has offered to do what he can for us. Mr. Fleay reports that next February the baby Duck-bills will be emerging from their underground nests, at the

age of about four months, and he is confident he could capture a trio and send them to us by air, if governmental permission is granted.

If we get them, the next goal to strive for is a duplication of Mr. Fleay's feat: to breed them in captivity. Ten years—eleven summers of exhibition—have taught us a great deal about the management of Platypuses and we have some ideas about modifications of the Platypusary that would give them a "down under" climate at their normal breeding time, which is the beginning of our winter. It is an exciting prospect.

George Scott Retires But Is Busier Than Ever

George Scott retires officially as Head Keeper of Birds in the Zoological Park on November 19, although his last day of actual work came in mid-August, because of "accumulated time." In theory he is now free to retire to his up-state farm and begin vegetating among his vegetables. Instead, Mr. and Mrs. Scott left by air on August 27 for Caracas where Mr. Scott will set up an aviary in connection with the Venezuelan Fair in 1960.

Not only will he superintend construction of the aviary; he will collect the birds and train a staff to take care of them in later years when the aviary is incorporated in a new zoological garden being established in Caracas. Having spent the summer in New Orleans giving two Whooping Crane chicks a good start in life, and now plunging into the Venezuelan job, his "retirement" is actually the beginning of one of the busiest periods of his life. Mr. Scott came to the Bronx Zoo on May 14, 1923, from England.

Bird Department Now Boasts of Its Four Puffins

The Bird Department collection was enriched by the acquisition of four Puffin chicks at the end of August. To the best of our knowledge, no zoological garden now has a satisfactory exhibit of these amusing little "sea parrots," and we are looking forward to making the attempt ourselves.

They were collected for us by Stewart S. Peters of the Newfoundland Mines and Resources Department. To date they are not on exhibition, while ways of displaying them are being worked out. What they look like in their juvenile stage may be seen on the cover of this issue of *ANIMAL KINGDOM*. More — much more — will be heard of them in later issues! — WILLIAM CONWAY.

Associate Curator Appointed in Mammal Department

Dr. John L. George has been appointed Associate Curator of Mammals at the Zoological Park and entered upon his new duties on September 16.

Dr. George is a native of Milwaukee. He received a B.S. degree in forestry at the University



Dr. John L. George

of Michigan in 1939 and the M.S. and Ph.D. degrees from the same institution in 1941 and 1952, respectively. From 1942 to 1946 he was a lieutenant in the Navy, serving in both the Atlantic and the Pacific, and in 1946-47 he was engaged in insecticide research with the U. S. Fish and Wildlife Service. From 1947 to 1950 he held Horace H. Rackham Fellowships at the University of Michigan, and since 1950 has been Assistant Professor of Zoology at Vassar College.

Dr. George has written numerous technical papers on mammals, birds and insecticides, and with his wife, Jean C. George, is the author of six entertaining books of animal biographies for young people.



Our first baby Yak in fifteen years was born on September 2. It has been named "Herbert" in honor of Comptroller Herbert Schiemann, the staff officer on duty on Labor Day.

PUBLICATIONS OF INTEREST

HOLD THAT TIGER! By Sam Dunton. Sixty-three photographs in black-and-white. 188 pages. Published by Greenberg, New York, 1957. \$3.95.

Any book by the Zoological Society's staff photographer, Sam Dunton, is bound to be worth reading. His previous efforts must have proved absorbing to the great guild of photographers but this book will have much broader appeal, since technical details of no interest to the general reader have been relegated to a brief section at the back. Intimate accounts of experiences in photographing the Zoo's own rarities and in recording the activities of numerous staff expeditions, told with the author's well known modesty, are given from a refreshingly different point of view. While many of the photographs have lost much in reproduction, all are definitely Dunton and therefore basically good. One point that may not be evident, even between the lines, should be mentioned here. While the author makes something of his efforts, not always successful, to avoid injury to himself, he says nothing about his effect on his subjects. It is therefore left to this reviewer to place on record the fact that the great secret of Sam Dunton's success is that never, in all his long experience with us, has he caused injury or death to any animal subject. Few workers in his special field can say as much. — L. S. C.

HUNTING WITH THE CAMERA. Allen D. Cruickshank, Editor, and others. 215 pp., 41 photographs, 1 in color. Harper & Brothers, New York, 1957. \$4.50.

Allan D. Cruickshank, the well-known photographer of wild life, has produced a valuable book for any photographer, amateur or professional. He has written the sections on birds and mammals, and under his edi-

torship Charles E. Mohr treats of amphibians and reptiles, Edward S. Ross discusses insects, Herman W. Kitchen contributes a chapter on marine life, and Rutherford Platt handles the photography of plants.

Emphasis is properly placed on the blinds, baiting and other devices essential to wildlife photography, rather than on complicated photographic technology. Exposure data for the superb illustrations are given in a separate section, and there is a detailed index.

"Hunting with the Camera" should give any photographer a good start down that pleasant path that leads to green forests and far horizons. — S. D.

ZOO DOCTOR. By William Bridges. 41 photographs in black and white by Sam Dunton, 4 by Arthur Sasse. William Morrow & Co., New York, 1957. 126 pp. \$2.95.

This small volume, ostensibly intended for children but actually limited to no age level, has a special charm. For while it contains much sound information about animals and good Zoo practice, its basic theme is the sympathetic relation between animal and man, especially developed when the animal needs help and the man is able and eager to give it. The stories are good — and true! — and the illustrations are excellent. Parents who do not wish their children to become Zoo veterinarians should beware! — L. S. C.

ZOO QUEST TO GUIANA. By David Attenborough. Pp. xii, 1-252, 5 ill. in color, 45 photographs. Thomas Y. Crowell Company, New York, 1957. \$4.50.

This account of an expedition to British Guiana in South America describes a journey in quest of animals fostered by the Zoological Society of London. The illustrations are excellent and the story tells of visits to four jungle localities where the animals and the Amerindians vie with each other in producing material for this very good book. — J. T-V.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1957)

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WHITE CEDAR ROOTS

FOR YEARS people have been trying to find good perches for birds in our Large Bird House. That isn't as easy as it sounds, because the perfect perch must be strong, attractive and maneuverable. Zoo Climbers and Pruners are always on the lookout for likely branches, and Curators in search of just the right limb for finches to preen on, have been chased by bulls and stung by bees.

A few weeks ago, a hot tip led Headkeeper of Birds Joe Bell and his men to the pine barrens of southern New Jersey to investigate a report that white cedar roots were being dug up by monster road machines excavating for a new highway. The roots were there all right, and the Bird Keepers quickly selected a truckload to bring triumphantly back to the Zoo. White cedar roots are ideal for cage decoration and their delicate intertwinings provide crannies and singing posts dear to the passerine heart. Make a point to notice them the next time you visit the Bird House.

What's particularly nice about all this is a sort of poetic justice: the nest-providing tree demolished by the road-diggers can once again lend its sympathetic wood to the needs of a bird.

Members will soon be getting a report on another expedition, this time from George and Jeanie Treichel. The Treichels are winding up their year-long investigation on the status of African wildlife and have sent word that Newsletters* will be mailed to Members from Cape Town some time in October.

*** We expect that there will be extra copies. Why not send us the names of a few people who might like to receive this Newsletter? Just write the names on a two-cent postcard and mail it to:**

MEMBERSHIP DEPARTMENT
The New York Zoological Park
New York 60, New York



ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LX DECEMBER No. 6
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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.



It doesn't seem possible to take a picture of a Gerenuk in an awkward and ungraceful pose. The alert, intense gaze, the delicately poised foreleg, in this photograph are typical of the attitudes "Gerry" struck for Staff Photographer Sam Dunton — not once, but repeatedly — when he went down to the Antelope House to get a cover picture for *Animal Kingdom*. For a while, though, we thought we would have to settle for a photograph of the Gerenuk standing on his hind legs with his forefeet on Keeper Dapolite's chest or shoulders; the keeper had been feeding him bits of banana and he wanted to go right on enjoying that luxury.

Destiny and Dollars

A FEW INSTITUTIONS—of which ours is one—proceed through the years under the influence of an unusually favorable destiny. This destiny may be described as “an irrepressible tendency to grow.” The history of our Society from its formative years half a century ago is a story of the acceptance of opportunities and progress. Similarly an unending series of opportunities faces us in the future. The question is, “Can we meet them?”

This brief soliloquy concerning our Society and its “place in the world” is currently exemplified by the announcement of the establishment of the new Department described on the following pages. A careful reading of this announcement will convey the importance of this new activity that will be undertaken by some of the members of our staff and their associates in other institutions. Without minimizing the significance of this highly important plan, it is only one of a number of “high priorities” for which we must gain very substantial financial support.

I happen to believe in the adage “ideas come cheap.” It is always a question of the dollars with which to carry them out. This may not be invariably true, indeed it is *untrue* in the sense of an individual’s creative accomplishments, but it is everlastingly true in the case of our Society which is dedicated to public interests on so large a scale.

The goals still to be reached include the completion

of the new Aquarium that can one day be the greatest in the world, a program of constant improvements at the Zoo, the advancement of work in conservation including especially the protection of wildlife, stimulation of our educational activities and, finally, the seeking of greater knowledge of life processes through expanded programs of scientific research. These objectives cannot be reached without large sums of money either in the form of direct gifts, or, for the long pull, in the form of legacies. Our Society has indeed an "irrepressible tendency to grow." We have a special obligation to refresh people's lives with the living wonders of nature at a time when men's thoughts are so dampened by the stresses and preoccupations resulting from the arrival of the atomic and missile age.

Our Society seems to have the reputation of being "comfortably well off." This is a total misconception if our present resources are measured against the things we must accomplish. Never in our history have we been in such financial need because never before have the opportunities for growth been so evident.

Fairfield Osborn



A New Department of Marine Biochemistry and Ecology

By FAIRFIELD OSBORN

IT IS A GREAT SATISFACTION to announce the establishment of a new department to be known as the Department of Marine Biochemistry and Ecology. It has been the practice of our Society to endeavor to handle its varied activities through an administrative set-up that is not broken down into too large a number of different divisions of responsibility. As evidence of this policy, the last time a separate department became formally established was in the year 1916 when the Department of Tropical Research came into existence under the direction of Dr. William Beebe.

However, there can well be exceptions to any general rule. In this instance we believe we are presented with an extraordinary opportunity for scientific accomplishment in a field which is as yet relatively unexplored. Scientists have long recognized the importance of controlling temper-

ature, alkalinity, oxygen, carbon dioxide, nitrogen and salt content of sea-water in order to properly maintain marine organisms in captivity. Members of our Aquarium staff, who are familiar with aquarium management, have also recognized that there are more subtle factors that may affect the health of fishes and other marine life. For instance, water in which sharks or their relatives have been kept for some time is known to be unsuitable for many other fishes. Certain fish placed in such water will soon lose their bright color, normal behavior pattern and appetite, and may eventually die. The factor or factors responsible for this effect are found in the substances called metabolites, which are secreted or excreted by sharks. The process of modifying the biochemical nature of water by organisms is called *conditioning*. This is now recognized as a basic principle in aquatic biology.

It is known that *conditioning* factors are usually present in relatively small amounts. Modern technology has made it possible to determine the kinds and amounts of organic compounds in the marine environment. Thus, biochemists have demonstrated that biologically active substances such as steroids, carotenoids, polysaccharides, amino acids and vitamins are present in varying amounts in different environments of the sea. By the use of sensitive micro-organisms some of our collaborators have been able to detect the presence of Vitamin B₁₂ in aquatic environments. This knowledge helps to explain the "blooms" of the highly lethal "red-tide" organism (the dinoflagellate, *Gymnodinium brevis*), which also requires this vitamin for proper growth. The toxic

behind the scenes" in the Stage One building of the new Aquarium at Coney Island Dr. Ross F. Nigrelli has a laboratory equipped to work on most of the problems that concern the new Department.

substance which is responsible for catastrophic tolls of fish, birds, marine mammals and invertebrates in warmer seas has not been definitely identified. Apparently it is an alkaloid with strychnine-like action

Holothurin, a powerful poison produced by a sea cucumber (*Actinopyga agassizi*), was first isolated by Dr. Ross F. Nigrelli, our Aquarium pathologist. This substance is now the subject of an intensive investigation by our staff and by collaborating biochemists. This material is a digitalis-like steroid saponin, and animal experimentation has shown that it has some anti-cancerous, anti-blood-coagulating and heart-stimulating properties. An understanding of the chemical formula may lead to a modification or synthesis of a less toxic and more useful drug. The biochemical and pharmacological studies of this compound are being supported by our Society, the National Science Foundation, the Office of Naval Research and the Damon Runyon Memorial Fund.

Many of the members and friends of our Society are probably unaware that research activities such as the above are intimately associated with the proper management of a large marine aquarium. The factors that lend themselves to study

are basically similar to those investigated by oceanographers, limnologists and marine biologists generally. Each aquarium tank with its individual water circulation represents a working model of an ecological niche where all the physical, chemical and social factors are interacting to affect the community as a whole. The differences between a biotic system in an aquarium and in a definite area of the ocean are mainly quantitative.

The study of these *conditioning* substances is just one of the basic purposes of the new Department of Marine Biochemistry and Ecology. We feel justified in hoping that further knowledge of these substances will lead to a better understanding of the biochemical processes of marine ecology and will help to solve the riddle as to why the composition of phyto- and zooplankton undergoes drastic changes in different parts of the ocean. This knowledge is important if we are completely to understand the economy of the oceans and, in turn, to utilize marine resources that are potentially available for human welfare. Although it is well known that the oceans and seas make up slightly more than 70% of the earth's surface, it is not generally recognized that acre for acre the sea has a greater productive potential than the land.

It is fortunate that the first unit of the new Aquarium at Coney Island presently contains a laboratory well equipped with modern instruments and other technical aids. As the Aquarium grows we may hope that these laboratory facilities will be extended. In any event, present facilities are adequate to provide the initial background for the work to be done by this new Department, while at the same time the laboratory fulfills its primary task of maintaining the marine collections in the Aquarium in good condition.

This new Department is the first of its kind in the United States. The advantages of the location are great both as to geographical position and the availability of academic and other specialized personnel. The Department will be under the chairmanship of Dr. Nigrelli, whose accomplishments in his field of scientific research are already so widely recognized in our own country and abroad. We feel sure that he and those associated with him, within and outside our own organization, will gain rich results in this challenging field of scientific exploration.

TWO

"FIRST-TIMERS" FOR THE ZOO



THE GERENUK

By OLIVER MILTON

Former Game Ranger, Tanganyika Game Department

USUALLY, I am told, only members of the staff, and keepers, and sometimes newspaper reporters and photographers, are present when an important new animal arrives at the Zoological Park. The reason is that an atmosphere of calmness and quietness must be maintained when the animal — often shy and apprehensive — is introduced to its new home.

I was especially privileged, then, on the afternoon of October 1 to be in the small group in the Antelope House when a keeper slowly raised a sliding door and, after a slight pause, out stepped a male Gerenuk . . . so delicate and graceful that the onlookers audibly gasped at his beauty. It was the first Gerenuk to be on display at the Zoo, and everyone — save a few who had visited East Africa — was seeing this species for the first time.

The Gerenuk (*Litocranius walleri* Brooke) is a curious-looking little antelope and the Kiswahili name of "Swala twiga" is apt. It means "antelope giraffe." The uniformly light brown head with white patches near the eyes is comparatively small and rests on an absurdly long and

thin neck about eighteen inches in length. The great, dark, almost black, eyes seem too large for such a little head but owing to their height above the ground they enable the Gerenuk to get a good view of the surroundings and locate any possible enemies. As Leopard and Cheetah share their environment, Gerenuks fall easy prey to these swift killers. Their relatively small chestnut-brown body is supported by legs so delicate that the slightest blow must surely break them, and yet in the wild they seem to suffer no such misfortune.

"Mahali pa swala twiga" (Place of the Gerenuk) was the name I gave to a few acres of isolated thorn bush country about twenty miles north of my home at Lake Manyara in Tanganyika. I christened it thus because every time I visited the area during my term as Game Ranger — from 1949 until 1955 — I saw Gerenuk. This was the southern limit of their range, which extends north through Kenya to Somaliland and south Ethiopia.

They reminded me of a party shipwrecked on a lonely island. To the west the forest-clad Rift Wall rose almost perpendicularly from 3,500 feet to the 12,000-foot grassy peak of Ela Nairobi (Masai for "The-[Place]-of-the-Cold"), slightly

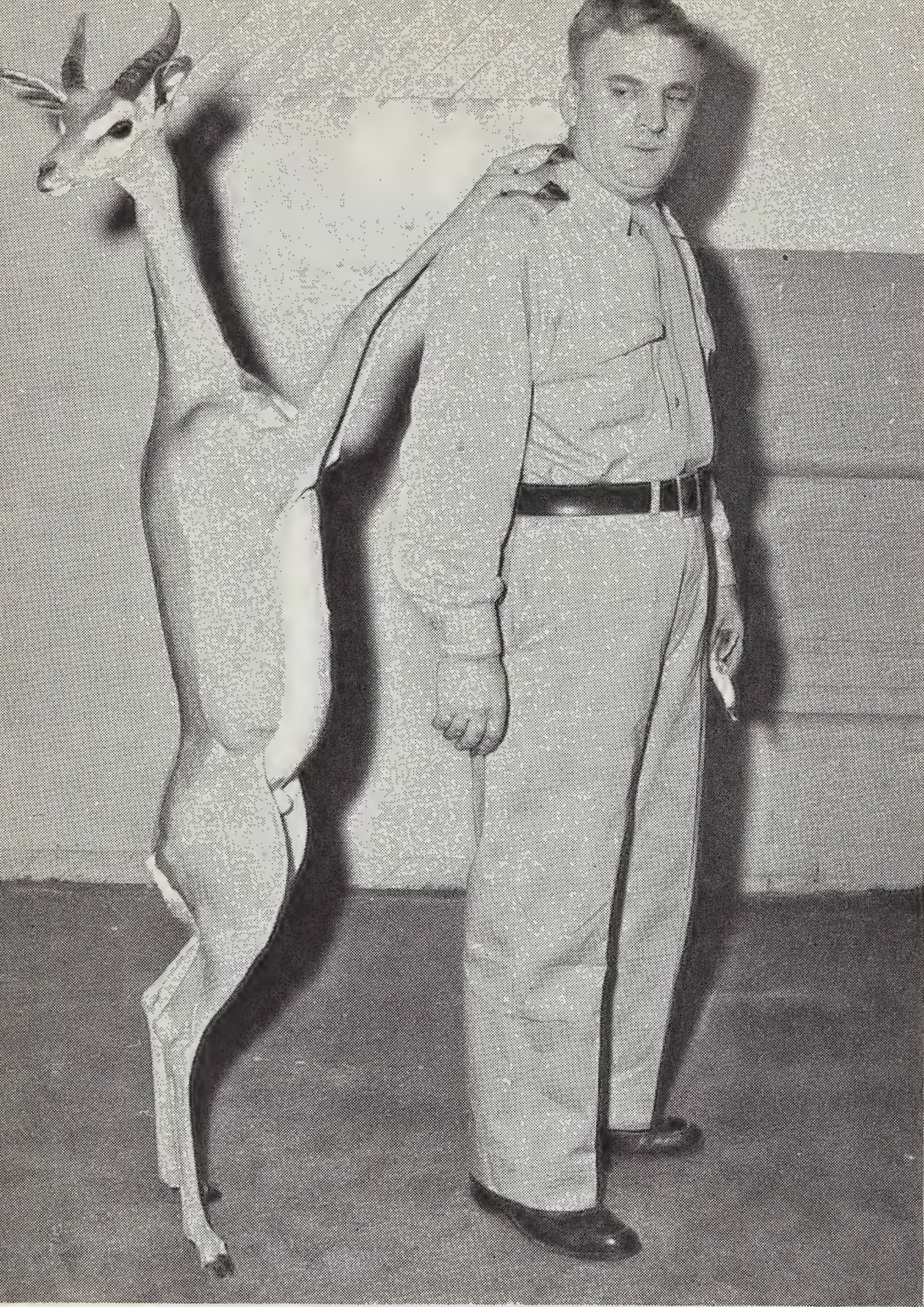
near this anthill in Tanganyika the author could be certain almost always of finding one or more Gerenuks, although at the first sight of him (or for no apparent reason) they often trotted away, as below.

Photographs by the author

northeast of Ngorongoro Crater. To the east great plains, dotted here and there with acacia and euphorbia, stretched to the foothills of Monduli mountain. To the north the country had once been covered with bushes but now, over-run by the Masai and their cattle, the land had been turned into a desert of dust and dead stumps. Nearby lay a vast soda lake from which, during the hot month of October, great clouds of choking pink dust would rise to several thousand feet and then, blown on a gentle breeze, slowly smother the countryside in a silent, pale red darkness. To the south the environment was little better and it was a spot favored by hunters from many countries.

Each time I drove there I would stop near the base of a small rocky hillock because the thorn bushes started to grow several hundred yards ahead. Many of the bushes were draped with the pendulous nests of the Sudan Dioch (*Quelia*) which became so numerous that they were a threat to the farmers who lived several miles away. In flocks of many hundreds these little birds would make daily sorties to the fields of wheat and devour literally bags of grain. The bushes sheltered the Francolin and Guinea Fowl during the hot hours of the day. One could guarantee seeing two or three of these birds lying in a heap of scratched up dust against the shady stems. The bushes also afforded cover and food for the Gerenuk and as their sense of sight was very acute I would examine the area carefully





Probably because it was hand-reared in Africa, the Gerenuk likes human companionship. Keeper Dapolite quickly made friends, and finds time every day to play with "Gerry."

and stare at me without making a movement until suddenly, and with no apparent reason, they stretched their necks in a horizontal position and loped away in a peculiar trot, lowering their heads still further to pass beneath the thorny branches.

Their habitat is usually far from water. Except during the rainy season when the ground is covered with puddles, they obtain water, like many other animals, by chewing the bark and roots of various acacias and succulents.

The young are usually born in time to enjoy the tender new leaflets that appear with the first rains, but like the new-born Thompson's and Grant's gazelles, they are in danger of being seized by the roving, ever-hungry Hyaena.

Gerenuk are not sought after by most hunters. They are not found in herds, but singly or in pairs except when with young. Perhaps it involves too much time to find one or maybe the size of the trophy is not considered worth the effort. Furthermore a shooting license costs about \$110 and this is an additional deterrent.

At any rate there are still numbers of Gerenuk in the bush, and I feel sure that when visitors to the zoo see the fine male specimen that has just been acquired they will agree that the animal is well worth preserving.

with my binoculars, hoping to see them before they saw me and moved to thicker cover. Nature has equipped many species of wildlife with some sort of camouflage and although Gerenuks stand about four feet high it is sometimes impossible to spot them. When they "freeze," their spindly legs appear as stems and the remainder of the body is hidden by the tangle of branches and twigs of the thorn bush.

There is little difference between the sexes except that the male has heavily-ringed horns which attain an average length of fifteen inches. The record is seventeen and a half inches.

Their diet consists largely of acacia leaves which they pluck with their long, plum-colored tongue. To reach foliage a little higher off the ground they rear up on their hind legs and, like a goat, support their fore legs on the upper branches of the bush. Because of their thin body and the light color of their bellies, it is especially hard to see them in this position.

They seem to have a natural curiosity and I have often watched a pair of them just stand

THE LESSER KUDU

By JOHN L. GEORGE

ALL OF US — visitors and staff alike — have been so entranced by the grace and gentleness of the first Gerenuk in the Zoological Park that we are in danger of overlooking another newcomer from Africa that arrived at the same time. This is a female Lesser Kudu, *Tragelaphus imberbis*, also being seen for the first time in our collection and housed directly across the hall of the Antelope House from the Gerenuk.

The Lesser Kudu has been described as "undoubtedly the most beautiful of all Somali antelopes," and one does not have to have a wide acquaintance among Somali antelopes to recognize this as a lovely creature indeed. It is only about half-grown (the Lesser Kudu weighed 63 pounds on arrival, the Gerenuk 42 pounds) and its general color is a warm brown. Its sides are vividly marked with white stripes; these are seldom bi-symmetrical and our animal has 14 stripes on her right side, 13 on her left. There is a broad transverse bar of white at the base of the throat and white markings below the ears and eyes. The native name is "Adir," meaning the possessor of stripes.

Male Lesser Kudus are much darker and have spiral horns two or three feet long. They are said to be found singly, as a rule, but may join females and young to form a small herd of four or five animals in the dry bush country of the lowlands, sometimes in quite waterless districts.

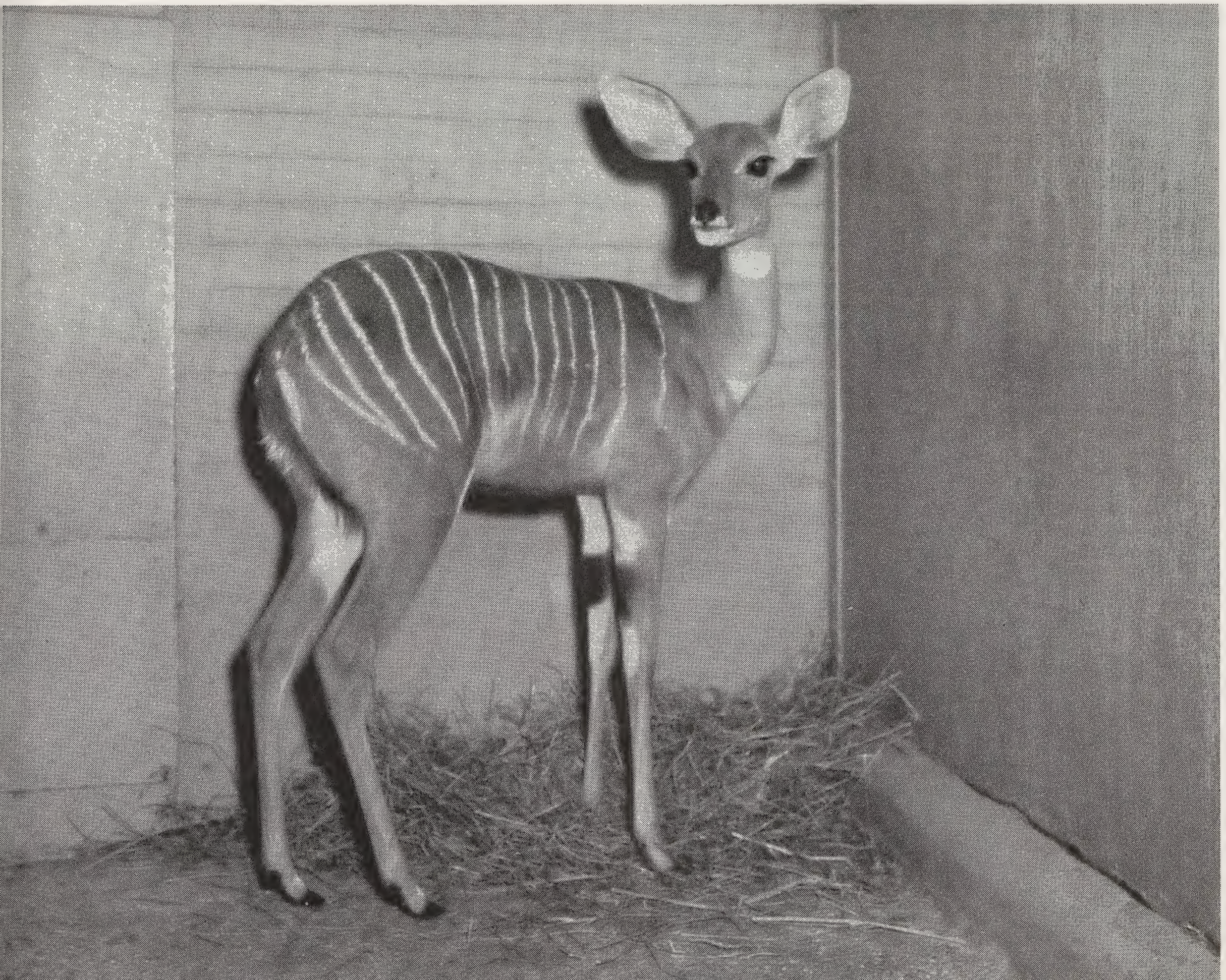
Like many mammals of the bush country, these little antelopes are most difficult to see when they are standing motionless, and they may allow one to get very close before they spring away. In

dense bush they use a jumping gallop and have been seen to clear bushes six feet high and to leap thirty feet when pursued by Hyaenas or Wild Dogs or Lions.

In the wild the Lesser Kudu browses shrubs and succulent growth, but in our Antelope House the "Adir" is prospering on grains and carrots, bread and bananas. She enjoys company and will come to her keeper to be stroked on the head and neck.

In fact, both the Gerenuk and the Lesser Kudu are fond of human companionship, undoubtedly as a result of their early history. Both were taken as newly-born fawns in March of last year along the Juba River in equatorial East Africa (Somali-land). They were hand-reared at Gobwen, a small village near the place where they were taken, and in their first winter were sent to Mombassa and from there to New York.

The Lesser Kudu is perhaps naturally more shy than the Gerenuk; at any rate, she prefers to stay well away from visitors, although keepers can approach her if they move slowly.



The Surprising Story of

Hitch-hiking Discus Babies

By MYRON GORDON

Photographs by GENE WOLFSHEIMER

EVERY AQUARIST knows that the female guppy gives birth to living young, that the male Tilapia incubates its eggs within its mouth, and the male Betta builds a bubbly nest for its eggs and then guards it against all intruders. The reproductive behaviors of these fishes are the smaller wonders of the world which aquarists take pride in demonstrating to their

neighbors. Now they may add another wonder, because some fortunate fish fanciers have recently discovered that the five-day-old fry of *Symphyodon discus*, the king-size cichlid fish, after hatching from their eggs, swim straight to their closely hovering parents and climb aboard their saucer-shaped bodies to find both security and sustenance. A week or so later, when the young have gained more size and greater strength, they check out from their parental trailers, swim away, and face the world on their own.

I must confess that when I first heard fragments of this seemingly fantastic hitch-hiking, chuck-wagon, story about the Discus, I was skeptical. But my skepticism vanished when I read the convincing evidence that Gene Wolfsheimer, an extraordinary fish fancier of Sherman Oaks, California, presented — and supported by publishing a remarkable series of candid photographs of Discus parents and their young in action.

For almost a quarter of a century aquarists had endeavored to solve the riddle of the Discus's complete breeding habits. Within the first year of their arrival in the United States from the Brazilian Amazon in 1933, a pair spawned in Gustav Armbruster's aquarium in Philadelphia, and subsequently other fanciers obtained spawn and fry, but rarely has anyone reared Discus young in any numbers. Now we think we know their secret, and a surprising one it is.

When Armbruster bred the fish for the first time in 1934, he learned very little, for the eggs were infertile. Next year, in early May of 1935, the pair spawned again in an aquarium main-

Like sheep on a meadow, the cichlids nibble at the algal growth and scour the surface at the place where they intend to deposit eggs. Here the concrete upright has been cleaned.



tained quite warm at 85°F.; this time their eggs were fertilized and after three days the embryos hatched. Armbruster learned to feed them on tiny aquatic organisms and a few Discus were actually reared to adult size, but large gaps remained in our knowledge of their complete life cycle.

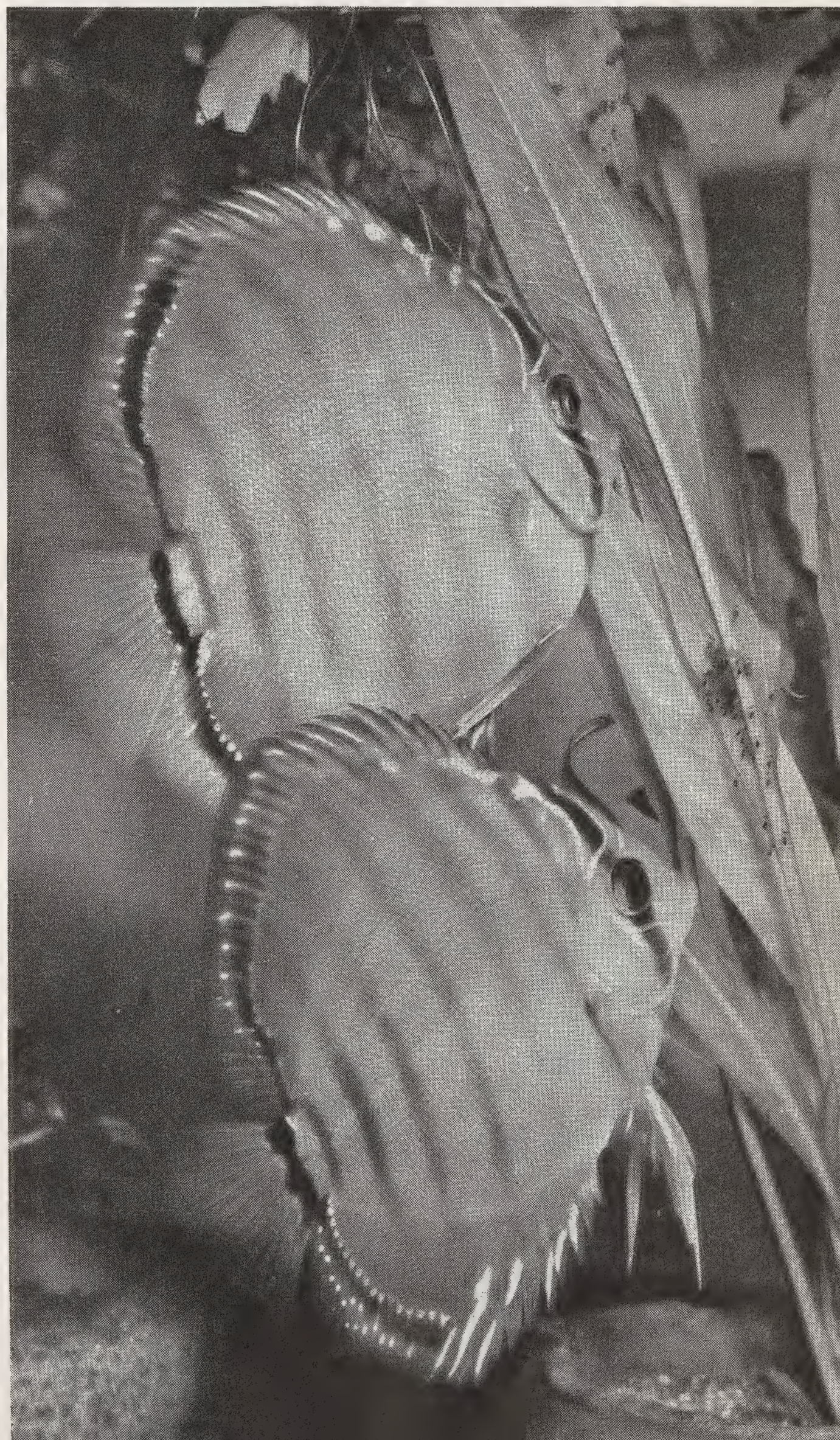
In the meantime, Dwight Winter of Pittsburgh also had obtained a pair of Discus and they spawned three times in his well-planted 100-gallon aquarium. The eggs of each spawning proved to be infertile and the parents ate them. This act may appear to be close to cannibalism, but in reality the pair were most likely motivated to remove all foreign objects from a site chosen for their next spawning. After they spawned for the fourth time, on a stone, the Discus parents transferred the hatched fry to the aquarium's water filter tube. Here the young led precarious lives because they kept falling down to the bottom of the aquarium. Although their parents rescued them repeatedly by sucking them into their mouths and spewing them out toward the filter tube, every young Discus eventually disappeared. On their fifth try the parents moved their fry to the roots of some water lettuce plants where some survived long enough for Winter to see them swimming and following their parents about the aquarium. If all had gone well, Winter perhaps would have discovered the secret of *Symphysodon*, but at this stage the parents deserted their young in order to spawn again. Winter rescued a few free-swimming young Discus but he could not rear them.

In 1938 Hansjoachim Mitsch of Berlin's Zoologischen Museum managed to rear 46 young, after removing the parents and replacing them by a mechanical aerator, but he, too, learned nothing of the offspring-parent relationship.

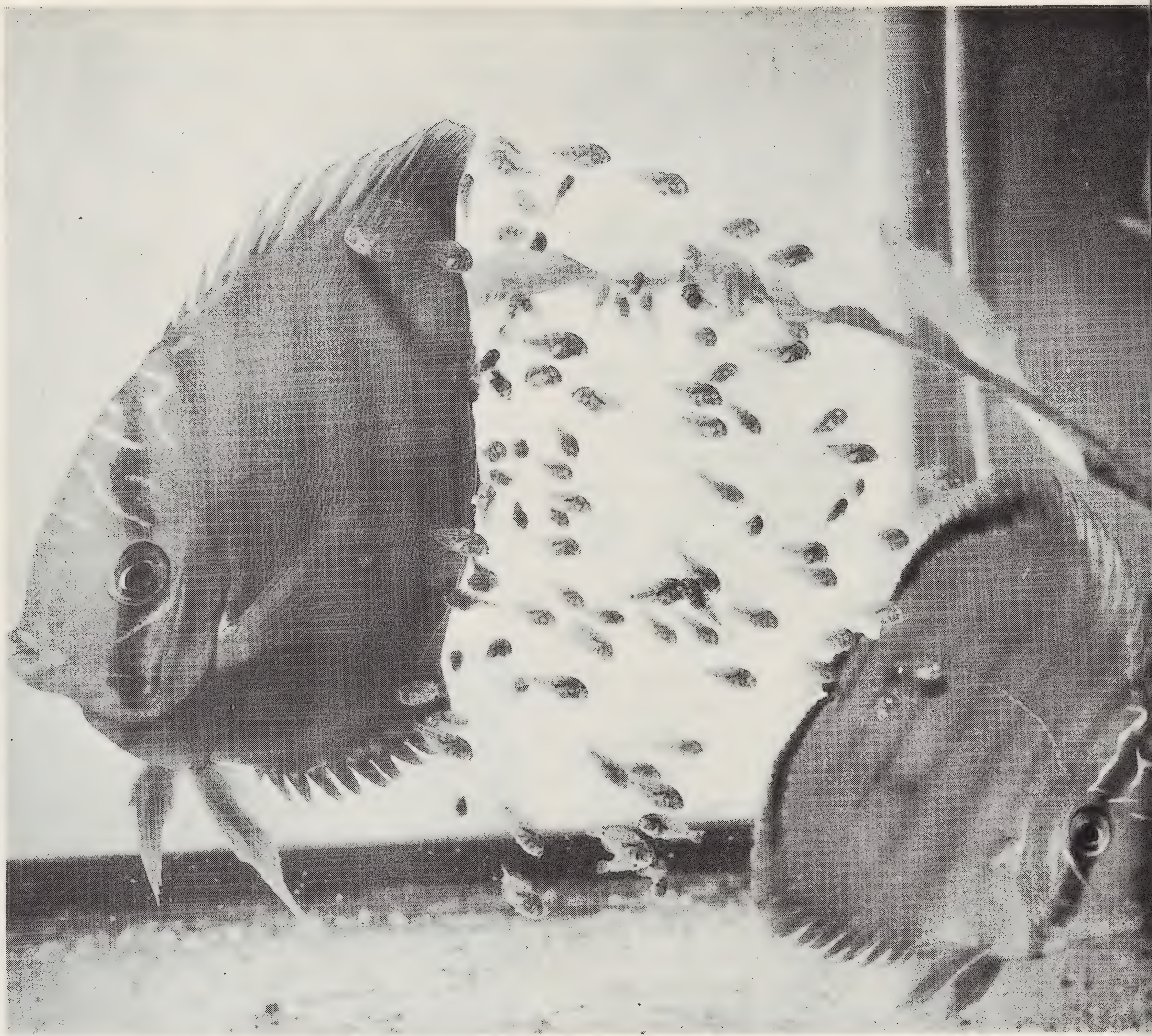
The first suggestion of the actual behavior came from the observation of Mrs. W. T. Dodd of Portland, Oregon, in 1949. After watching her Discus spawn and their eggs develop on the front glass of her 60-gallon aquarium, she reported that "the babies hung against the sides of

the parents, receiving free rides — using the breeders as landing-fields." This significant observation would have been lost had not Wm. T. Innes, editor of *The Aquarium*, spotted it in an obscure mimeographed monthly report of the Oregon Aquarium Society. Thus the way was paved for Gene Wolfsheimer's more detailed report, based on a few pairs he had under observation.

When biologically ready to spawn, both the male and female Discus work over a selected spawning spot. Like sheep on the meadow, they nibble away the algal growth and scour the undersurface of a leaf or stone with their strong nibbling teeth. Once the site is prepared, the female Discus extends her previously hidden genital tube (which now becomes quite conspicuous) and rubs it against the leaf or stone. Through this tube she emits a continuous linear



The eggs — tiny dark spots on the blade of an underwater leaf — are being fanned by the parents to create a constant flow of fresh water, and they may also "mouth" the eggs.



stream of clear, translucent eggs which instantly become attached to the site. The male follows in the female's path and sprays a cloud of milt over the eggs. Spermatozoa in the milt fertilize the eggs and thus a new generation of Discus begins its existence.

With fanning beats of their fins the parents hover at the spawning site and create a constant flow of fresh water for their oxygen-needy embryos. They also mouth the developing eggs frequently and this keeps them clean of injurious bacteria and other micro-organisms that, despite the fanning, might settle upon them. Like the orally-incubating cichlids, they may have antibiotic secretions which they impart to their spawn in the process of mouthling. When the female is

For the first four days after hatching, organic threads held the fry to the spawning site. Then they broke loose and swarmed aboard one or the other parent, for a free ride and food.

fanning and mouthling the eggs, the male guards the breeding site against intruders. At intervals the male moves up to relieve its mate, and then the two execute an exchange of duties most gracefully and without missing a single beat of their fins.

In Wolfsheimer's aquarium, which he maintained at 79° F., the Discus eggs hatched three days from time of spawning, but he noticed that the fry remained confined and helpless because each was attached by an organic thread to its



Most of the babies have made the transition from one parent to another. Apparently they find food on the skin of the parent.

How thickly the young cling to the bodies of the adults is well shown in this "tail-on" view. In about a week, the exodus begins.

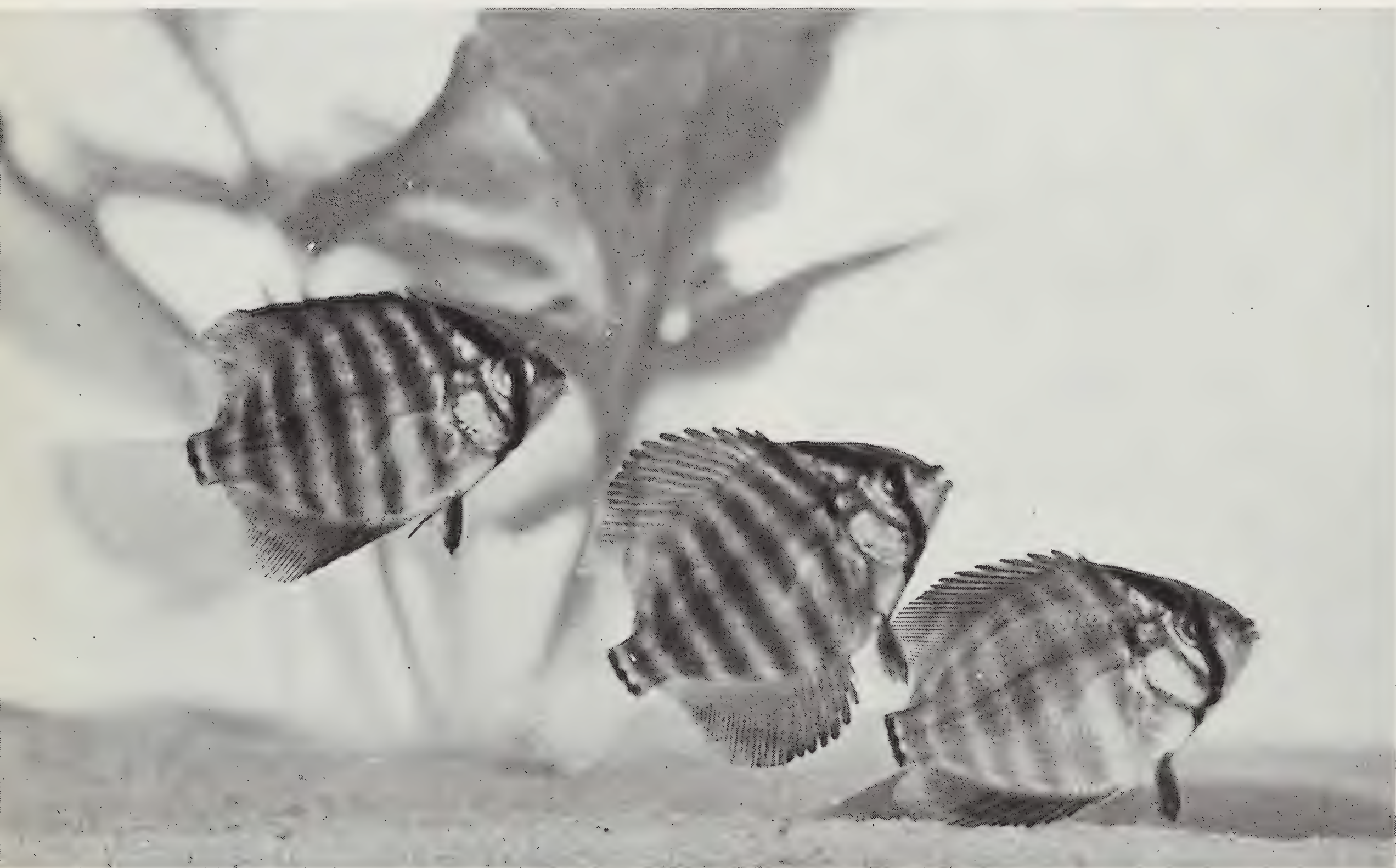
spawning site. Four days later, after having completely absorbed the last of their yolk, the fry broke free of their tether, made a bee-line toward their parents and climbed aboard. There they attained a double advantage — a free ride and a free lunch. Wolfsheimer watched them dig



their heads into the soft skin of their parents and then jerk their tiny jaws back and forth as if they were tearing some food particle loose. After nibbling a while on the mother-fish, some fry, expecting better pickings on their father, swam over and sampled him. Nobody knows what this home-grown food is. Gene Wolfsheimer thinks it is the slime on the body, although ordinarily fish slime is a protective secretion and slightly toxic. Perhaps the young Discus feed on some

to round out the life story. Do the fry during their attachment to their spawning site become accustomed and conditioned to the sight of the ever-waving fins of their guardians? When free of their tethered existence are they impelled to swim towards fanning fins because these movements have become critical "come-on signs" to them? Once aboard their parental diner, what do they actually eat?

These are some of the questions that aqua-



microscopic organisms that live commensally on the skin of their parents, somewhat like the organisms attached to the backs of some aquatic turtles.

After residing on the parental chuck-wagons for a week, the more enterprising youngsters dropped off, momentarily at least, to seize a hovering shrimp nauplius or tiny rotifer; then they returned to the parent. They grew quite rapidly and eventually left their anchorages for good.

While Wolfsheimer revealed the basic fact that the Discus fry seek and feed upon their parents' backs, there is much still to be discovered

Three young Discus, well beyond the age when they are dependent upon their parents. Much is still to be learned about their habits — much that amateur fish fanciers can learn at home.

rists might keep in mind. Amateur fish fanciers have already provided answers to some equally baffling questions concerning the remarkable lives of fishes. Every aquarist has the possibility of being a discoverer of new scientific facts if he looks upon his home aquarium as a miniature biological laboratory. He, too, may reveal a new small wonder of the world, and astonish his friends — and even scientists!

Is Temperature the Secret?

HOW TO FEED A BUSHMASTER

By JAMES A. OLIVER

MANY SNAKES — indeed, one might say all snakes — exert a fascination over people in proportion to their supposed deadliness. That being so, it is not surprising that the big, venomous South American snake known as the Bushmaster has a high rating as an attraction in reptile exhibits. The very name "Bushmaster" enhances its reputation. Unfortunately, it is not exhibited as frequently and as constantly as Zoo visitors — and Zoo curators — would like, because it seldom thrives in captivity.

Typically a healthy-looking Bushmaster comes into the collection, refuses all food or at best eats only once or twice, slowly starves, fails to shed its skin properly, and soon dies. It has almost reached the point where few zoological parks feel they can afford such a snake that is high in price and has a short life expectancy.

Now, however, we have undertaken an experiment that makes us hopeful of a better future for *Lachesis muta* in reptile collections.

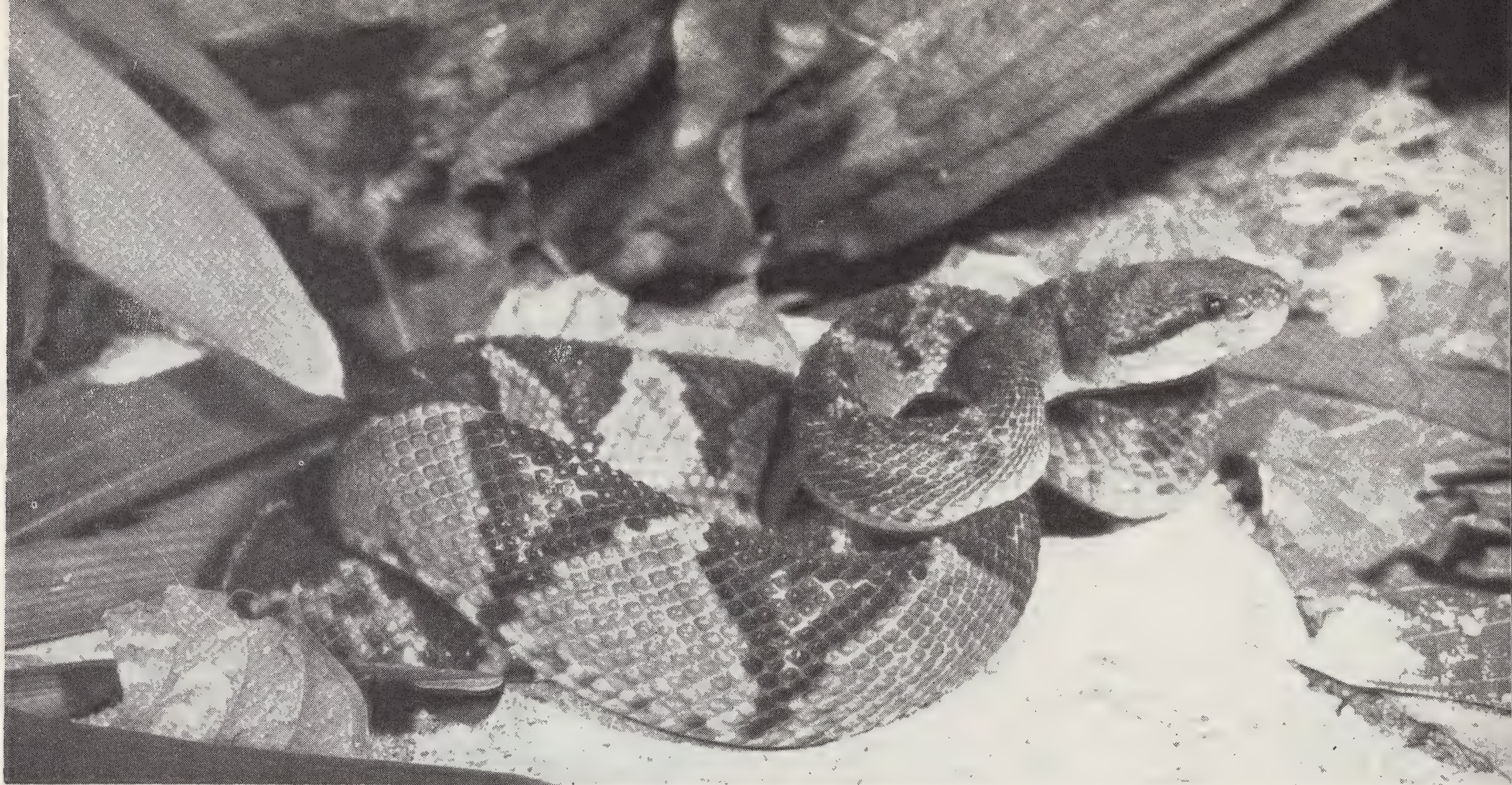
The best record I am aware of for a Bushmaster in captivity was set partly in the New York Zoological Park. On February 2, 1935, Prof. F. W. Urich of Trinidad obtained a young Bushmaster about 18 inches long. It fed readily enough on the wild mice he trapped, and by early October it had shed its skin twice and had grown to 20 inches. Knowing that Dr. Raymond L. Ditmars, then the Curator of Reptiles at the New York Zoological Park, was especially anxious to have a Bushmaster on exhibition, Prof. Urich sent it to him. It arrived on October 14, and on October 31 it ate its first meal in the Zoo. Thereafter it ate regularly and lived for almost a year, dying as the result of an accident on October 7, 1937. At death it was 40½ inches long.

From this experience, it seemed likely that a young snake might do better in captivity than an older and larger one, and we sent a request to Dr. William Beebe to try to have a baby Bushmaster captured by the people of his laboratory in the Northern Range of Trinidad. But Dr. Beebe reported that while he had seen many Bushmasters in the wilds of British Guiana, Venezuela and Trinidad, he had never seen a small one; as far as he was concerned they came only in large sizes.

Nevertheless, when I visited the laboratory in 1956 he performed one of his customary miracles and produced a 20-inch Bushmaster for me. This was almost too good to be true; the snake was almost exactly the size of the one Prof. Urich had worked with. Equally exciting was the fact that it started eating immediately, and ate with encouraging regularity.

In Trinidad, that is. For when I brought the snake to New York, it left its appetite behind and never accepted another meal. In a short time it died, as so many other promising Bushmasters had done. This was a frustrating experience. Why would it not eat in New York?

My next chance to work with a Bushmaster came last summer when Dr. David Snow, the resident naturalist at the Simla Station in Trinidad, sent us a sleek, 36-inch specimen caught near the laboratory. We tried to make it feel at home, giving it a cage with an area of earth, a living plant, a small box to hide in, a large water dish and a floor covering of dry cacao leaves. Anticipating our needs in case just such a Bushmaster as this one came along, I had brought back six frozen Spiny Rats, for Dr. Beebe and I had found that several Bushmasters killed in



Trinidad had fed on these animals. Unfortunately, the rats were too big for this small snake, so we tried rubbing other freshly-killed food on them to pick up their odor. We also tried wrapping dead white mice in the skin of a Spiny Rat. We tried many other kinds of food and all were consistently refused. It was the same old story repeating itself.

The normal place to keep a snake undergoing feeding experiments is in the Quarantine Room in the Reptile House, where the temperature ranges between 80° and 84° Fahrenheit — a temperature that seemed ideal for a tropical snake. But *was* it the right temperature?

The more I thought about this, the more I wondered. Such high temperatures are usual in the tropics in the daytime — but the Bushmaster is a snake that is active at night, especially on rainy nights, when the temperature is much lower. Tropical forests are not the continuously sweltering regions they are often pictured as being; many nights at Simla one sleeps comfortably under one or more blankets.

Years ago Dr. Beebe and Dr. John Tee-Van had recorded ground temperatures at night in the forests of British Guiana, and I had a few records of night temperatures in Trinidad. Examination of these figures convinced me that we should be keeping our Bushmaster at a temperature nearer 70° than 80°.

This certainly seemed an unorthodox heat level for a tropical snake, but when I remembered the

shivering nights that followed hot days I felt that it was worth a trial. Almost exactly one month after the Bushmaster had arrived in the Zoo, and after it had refused 12 offerings of meals, we moved the cage into our refrigerated exhibition area kept cool for the benefit of the Tuatara and salamanders. We did bring the mercury up a little, to 70°-72° Fahrenheit. Four days later the Bushmaster ate its first voluntary meal.

That was encouraging, but we were a little doubtful about leaving it for protracted periods in such a comparatively cool place, and so when it refused the next food offering we moved it back to the warm quarantine room. Four meals were offered and refused in the next two weeks, so it was returned to the cold room. The first food offering at the lower temperature was declined, but the next four were taken. A minor change was made in the cage and the next meal was refused, but the following four were taken.

Apparently we are on a road that leads to success, but we are still not sure what is the important factor. Is it temperature, or the relatively reduced light and greater quiet in the refrigerated unit, or is it simply that this snake started to eat for some unknown and even unsuspected reason? We do not yet know, but we have learned that a Bushmaster will eat and can digest food at a temperature of 70° Fahrenheit, and that this one ate more regularly and oftener than any Bushmaster we have ever had in the collection previously, except for the record specimen from Prof. Urlich.

We are still experimenting and trying to isolate the important factors; then we hope to check them against experiences with other Bushmasters. Some day, certainly, we will learn exactly how to go about keeping this interesting snake in captivity. In the meantime, this "pilot" Bushmaster is teaching us a great deal.

* * *

As I intimated at the beginning of this article, the Bushmaster has a bad reputation. It is not entirely deserved.

This is the way the public sees one of our Bushmasters. A large specimen is being exhibited in a one-way-glass compartment.

The Bushmaster sees only its own reflection in the glass, which now mirrors Photographer Dunton working from a door at the back.

It is the longest venomous snake in the Western Hemisphere, occasionally reaching a length of more than 12 feet. In consequence of its large size it has long fangs and can inject a sizable amount of venom. It assumes a peculiar defensive posture, drawing the forward part of its slender body into a series of obliquely vertical S loops, and from this position it can lunge out in a frighteningly high strike. People have died from the bite of the Bushmaster.

But apart from these facts, the true nature of this interesting snake is hidden in a tangle of exaggerations, conflicting claims and completely erroneous legends. In most of the areas where it occurs, from Costa Rica to Brazil, it is generally feared out of all proportion to its actual menace. Few persons are bitten by snakes, even fewer are bitten by venomous snakes, and — relatively speaking — virtually no one is ever bitten by a Bushmaster. Where statistics are available on snakebites in tropical America, the Fer-de-lance and the South American Rattlesnake account for far more human fatalities than does the Bushmaster.

As more and more information is gathered about this snake, it comes to be seen as a shy and retiring reptile that is usually bewildered by its contacts with human beings. We are hearing of

an increasingly large number of instances in which Bushmasters were handled with impunity, in the belief that they were harmless. Naturalists who have encountered them in the wild consider them a negligible hazard. Certainly they are not aggressive and do not bite without provocation. The evidence indicates that most or all bites occur when the snake is stepped on or come upon so suddenly that it cannot escape. Nevertheless I know two persons who claim to have stepped on Bushmasters without being bitten. Less than 10

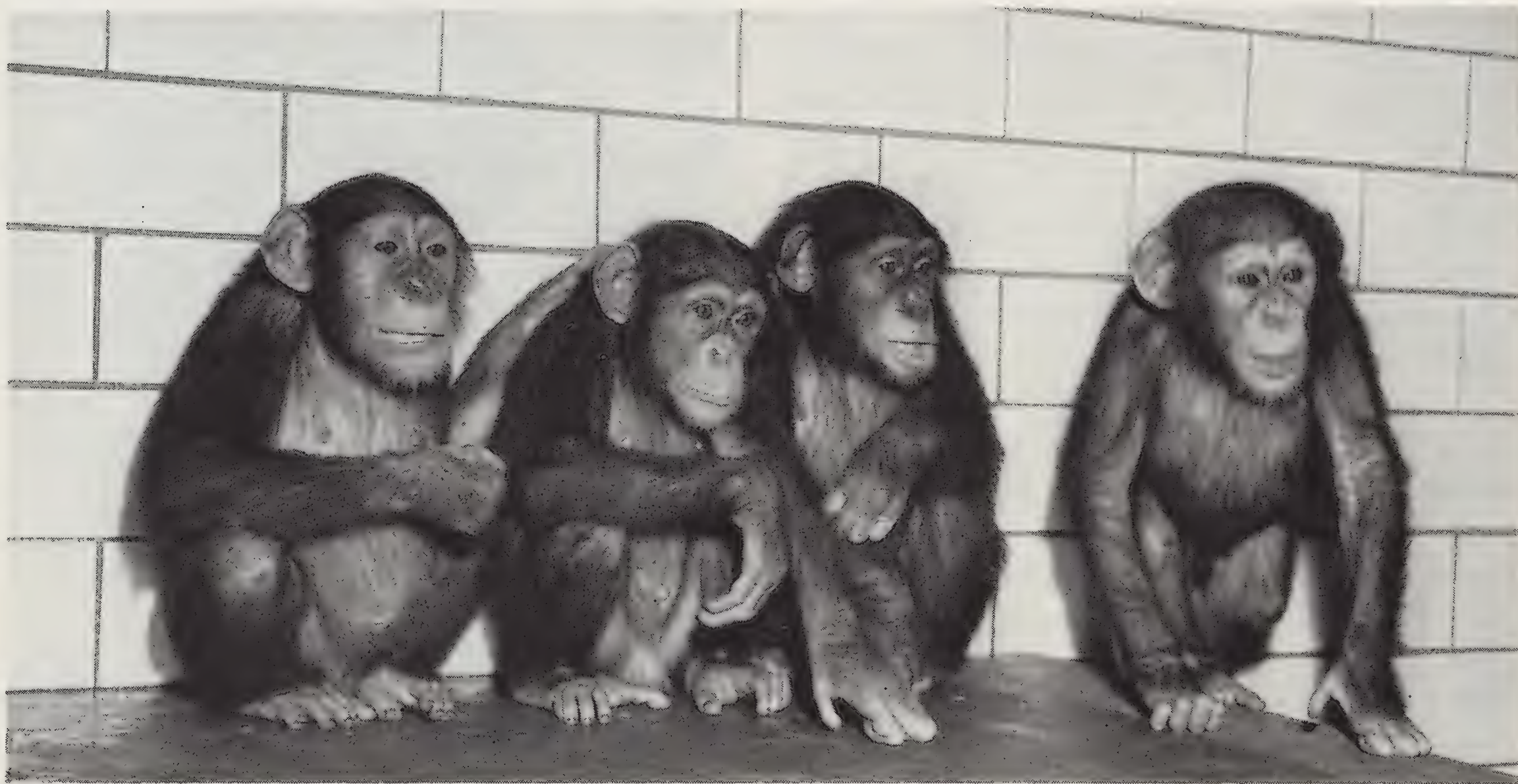


per cent of recorded Bushmaster bites were fatal.

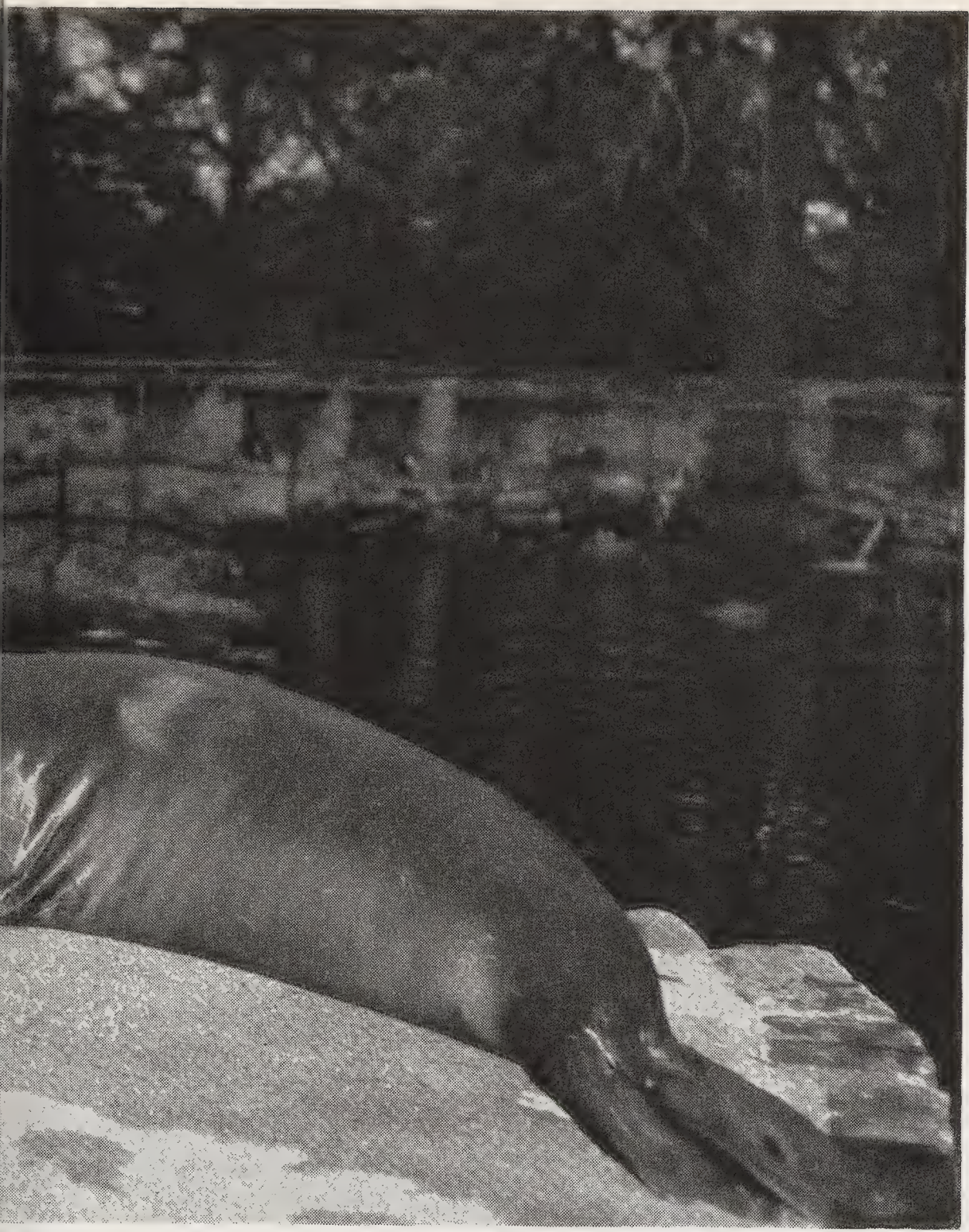
If it is not as bad as its reputation, it still has that sinister name, Bushmaster, to produce thrills in Zoo-goers. And for that reason if no other we are pleased at the prospect of being able to keep a Bushmaster in the collection.

Zoo News In Pictures

By Sam Dunton



When the Curator of Reptiles a few years ago suggested that we name our young **BLACK-FACED CHIMPANZEES** for the characters in "Little Women" — Amy, Jo, Beth and Meg — we were so taken with the idea that all young Chimpanzees in the Great Apes House collection have been given those names ever since. These are the latest. The four previous Little Women had begun to be just a little on the elderly side, and had lost much of their playfulness.



A modern psychologist (or perhaps a psychiatrist would be better qualified) should have some interesting observations to make about the young **ELEPHANT SEAL** so readily accepting a fish from the hands of Associate Curator of Mammals George while Assistant Head Keeper of Mammals Rolla and Keeper Viserto look on. This is the male Elephant Seal which became so aggressive towards "Olaf," the Walrus at the Aquarium, that he had to be transferred to the Zoological Park — and there, in the Sea Lion Pool, he in turn was so terrified by playful "Benny," a young California Sea Lion, that for weeks he ate almost nothing and seldom went into the water. In desperation we finally moved him to the comparative seclusion of the Seal Pool where his only companions are a female Harbor Seal and a female Gray Seal. Immediately his timidity disappeared, his aggressiveness did not return, and he is taking six to sixteen pounds of mackerel every day, with good appetite.

Family portrait: **DACCA AND HER LATEST CUBS.** Well before Christmas the cubs (now weighing about 100 pounds each) will be on their way to Europe and exhibition in some German zoological garden. They are the 28th and 29th cubs born to Dacca, our magnificent Tiger mother, since her own birth in the Bronx Zoo in 1944. Previous youngsters have gone to zoos in Belgium and Australia and in cities coast to coast over the United States.

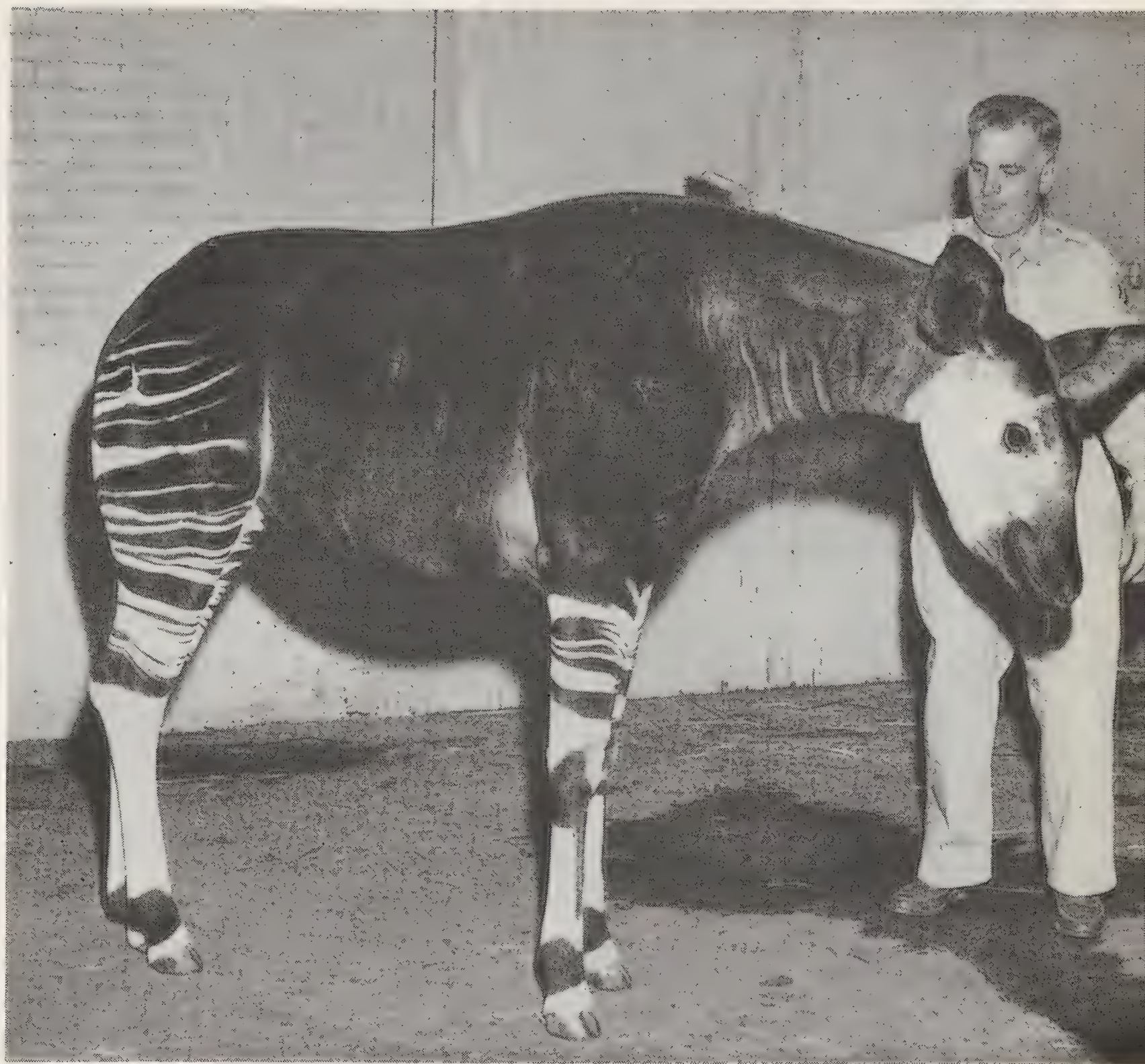




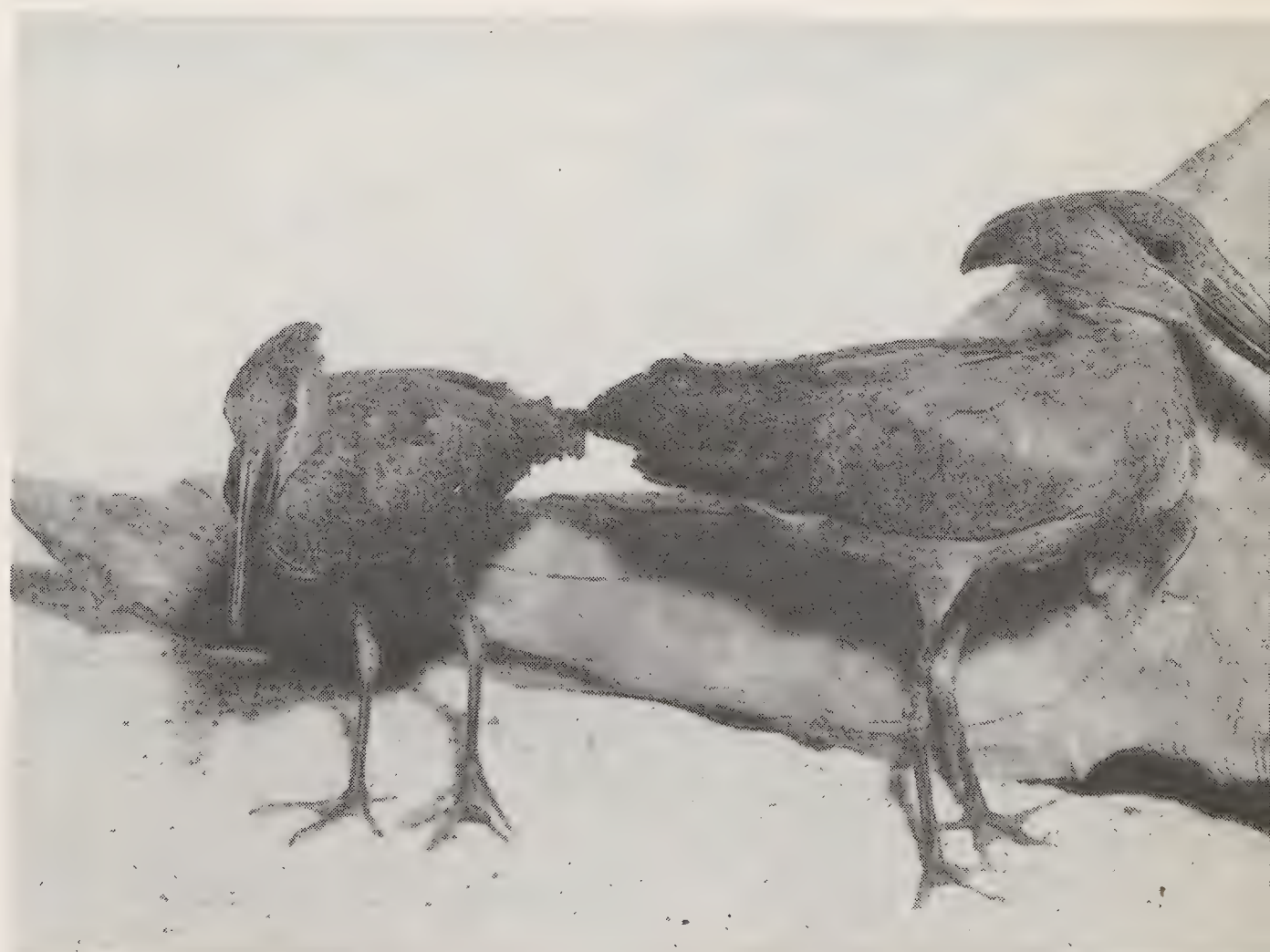
You might think the picture at the left represented Christmas morning in the Reptile Department. Actually it is the uncrating of a welcome gift of **MARINE IGUANAS**, **LAND IGUANAS** and young **GIANT TORTOISES** collected on the Galapagos Islands and presented to us by Rudolph Freund, an artist for Life Magazine. *Left to right:* Keepers Lannon, Cummins, Curator Oliver, Keeper Brazaitis. *Below:* This big Land Iguana rushed at Dr. Oliver with mouth open when first taken out of the box, but in a few days was accepting banana from his hand. *At Bottom:* A vigorous specimen of the **WATER COBRA**, *Boulengerina annulata annulata*, from Africa, a reptile we have been seeking for a long time. It will be put on exhibition in the Reptile House.

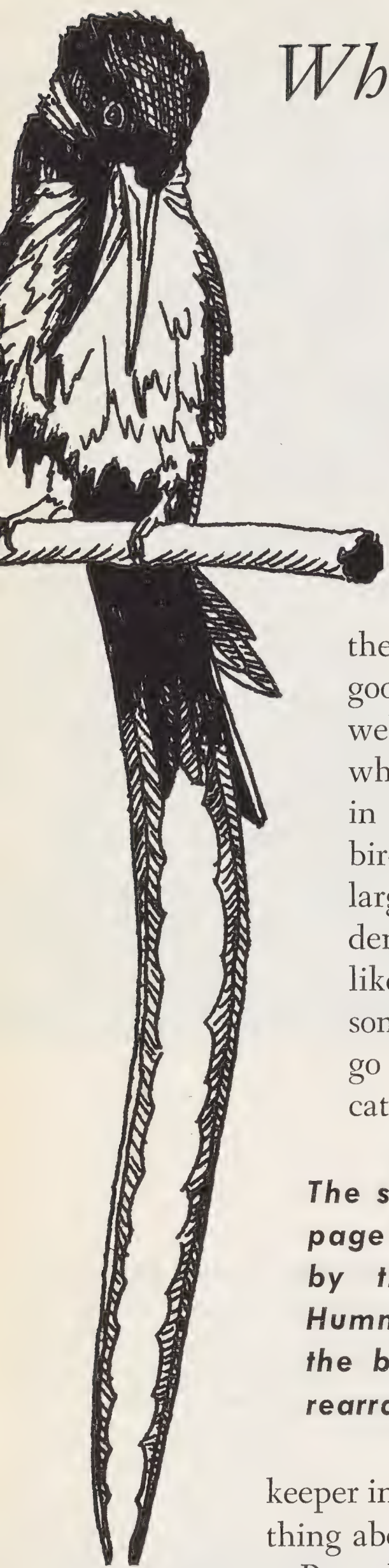


When "Muyoni," our female **OKAPI**, came to us from the Belgian Congo in the fall of last year, she was heavily infested with parasites and had numerous scars and abrasions on her skin. Since then, thanks to the well-calculated medication administered by Dr. Goss, the parasite count has dropped to safe levels, "Muyoni's" appetite has improved, she has put on weight, and the scars have almost disappeared. She obviously enjoys a daily rubbing down with a stiff brush by Keeper Dapolite.



Left — Some months ago this **LONG-CRESTED HAWK EAGLE** was shot down as it swooped low over a chicken coop near Arusha in Tanganyika. Its left wing was so badly damaged that it cannot fly, but it makes an impressive exhibit nevertheless. *Below* — These are the first **HAMMERHEADS** we have had in 20 years and they are now on display in the Large Bird House. Their home is Africa and Madagascar. Hammerheads are famous for their nests. They build a typical platform nest in a low tree, roof it over and end with a big, domed structure of sticks and twigs cemented together by mud. The birds enter this roomy nest through a narrow tunnel.





When a Bird Preen Itsself— **IT ISN'T VANITY!**

By WILLIAM G. CONWAY

Illustrations by the Author

BIRDS spend a good deal of time preening; zoo ornithologists spend much time watching birds; therefore, zoo ornithologists see a good deal of preening. And it is well that they do, and remember what they see, for not a day passes in which a knowledge of normal bird behavior goes unused in a large collection. Experience has demonstrated that sick birds are likely to preen their feathers in some abnormal fashion, or let them go unattended. Unkempt plumage catches the attention of a good bird

The sketches on this and the next page show various attitudes taken by the Red-billed Streamer-tail Hummingbird while preening. Both the bill and the feet are used to rearrange and clean the feathers.

keeper instantly and tells him to do something about it.

But the care that birds give their plumage is by no means a simple and uncomplicated business, and the novice must learn what is normal. A new employee once commented to me how interesting it was that a flamingo reached his long leg up behind and over his wing to scratch his head feathers, just as that long-legged shore bird, the stilt, does. I immediately went to see the flamingo in question, for while stilts do drop their wings and reach over them to scratch their heads, flamingos do not. Sure enough, this flamingo had done so because it had a broken humerus.

It took considerable periods of observation to

show the novice attendant that kiskadees, stilts and grosbeaks, for example, always reached up and over the wing to scratch their heads, while cranes, flamingos and many other birds never did. These birds just reach the foot up directly and scratch away. It is only natural to inquire, "Well, couldn't a bird change his mind and do it another way?" We'll have to answer no, not very likely. Head scratching patterns seem constant for the species and like much bird behavior seem to be a very narrowly channeled affair. I must confess a small and annoying doubt in making this dogmatic statement. I once thought I saw a normal Rose-breasted Grosbeak scratch his head from under the wing!

The purposes and advantages of normal preening are obvious. While feathers are wonderfully light, strong, elastic structures and make excellent cold and shock insulators, raincoats and aerodynamic surfaces, they are subject to dirt, disease and disorder. Preening with its accessory activities of bathing, dusting, and sunning is the avian system of personal hygiene. (These latter activities are all so complicated as to require separate consideration). While of course there are differences in preening behavior in bird groups, the similarities rather than the differences bring me up sharply from time to time. Watching a tiny Costa Rican Snow-cap Hummingbird raise and rotate its left elbow to straighten an underwing feather is thought-provoking; especially when one has just seen a huge North African Ostrich performing precisely the same maneuver.

Parasites such as lice and mites are at constant war with their bird hosts. Preening, especially by small, fine-billed species, would appear to be a very important parasite control and health measure, although we must feel that birds with large and comparatively clumsy bills, such as toucans and storks, would be at a disadvantage not only

in combating ectoparasites but in most other benefits of bill preening. It does seem strange that birds with greatly modified beaks such as parrots, eagles, spoonbills and flamingos have not evolved greatly different preening techniques. Some birds do seem to preen more extensively than others. Our Australian Tawny Frogmouth and our Whip-poor-will and night-hawks rarely preen, at least in the daytime when we can observe them. In contrast, some callistes and our native Downy Woodpeckers seem tirelessly concerned with personal hygiene.

Feather arrangement is one of the principal concerns of preening birds, and we need only to watch birds fly or maneuver to appreciate how important proper alignment of the plumage is to them. The feathers must constantly slide over one another without becoming enmeshed or damaged or offering resistance. Feathers, like hair,



are dead structures; if they are damaged they will not heal and the bird must wait until the next molt for replacement. Fragile as they may seem to us, they must have long-wearing qualities, for unless they are pulled out entirely (whereupon they start growing back immediately), they are replaced only once or at best twice a year.

A contour feather is not a solid unit but a complexly arranged branching structure. Two vanes, each composed of countless parallel, branching pieces with interlocking hooks, are centrally connected to a shaft to make up a feather. These fragile vanes are often separated by contact with solid objects, and one of the chief preening occupations of a bird is for the purpose of squeezing separated barbules back into position. I remember sleeping on an old-fashioned feather mattress years ago. It was not a new mattress, but the softness and springiness of this old bed surprised me. It was an impressive testimonial to the durability and elasticity of feathers.

Much of a bird's feather alignment seems to occur when it ruffles and shakes its plumage. Everyone who owns a canary or budgerigar is accustomed to seeing his bird suddenly grow in size as it raises its feathers at right angles to its body. A vigorous shake and vertical feathers are

pulled down one upon the other like a row of falling dominoes — in perfect alignment. Of course this activity is a stretch motion as well and illustrates the control exercised by birds over their feathers. Thousands of tiny muscles are devoted solely to the control of feathers and it is always interesting to watch the play of feather movement and control exercised during preening. I used to enjoy hearing visitors comment while watching a Bird of Paradise or Cock-of-the-Rock preening, "Why my Budgie does that!" Recently, however, I overheard a different inflection from a footweary father: "Humph! Our Budgie does that!" We now feel slightly apologetic that our magnificent rarities indulge in such a commonplace business as preening!

With the exception of penguins and a few other groups whose feathers grow evenly over their bodies, birds grow feathers in special areas called feather tracts. Except on these closely "planted" tracts, birds are mostly bare. We use this knowledge when assessing a bird's condition. Feathers often hide the emaciation of newly-imported birds and we part the breast feathers, which often grow only from the sides, to judge the bird's actual robustness by the plumpness of its breast muscles seen between the feather tracts. This method of judging health is especially useful when purchasing rarities from animal dealers. It may seem undignified to subject a lovely Quetzal in its coat of shimmering golden-green to such housewifely meatmarket tactics, but dealers' prices fall amazingly when confronted by a peaked breastbone!

The differences in basic preening patterns, from species to species, seem related to the distribution and location of the feather tracts. A bird with a long or ungainly bill, such as a toucan or stork, cannot preen the feathers nearer to its head than the distance the tip of its bill will reach. However, these birds can rub their heads and necks against their backs and scratch these areas with their feet. In this connection it is interesting to note



that some birds, such as herons and some goat-suckers, have special comb-like modified claws on their feet — although we are not too sure how they are used or with what degree of effectiveness.



The Kiskadee, like the stilts and grosbeaks, always reaches up and over the wing to scratch its head. Theoretically it could do this another way, but preening patterns are quite constant.

Human beings do not worry much about combing their hair, or about hygiene in general, until they are several years old, but preening is one of the first coordinated actions that birds perform. I have watched nestling woodpeckers and flycatchers make unmistakable preening motions before they have any feathers to be preened. Other birds such as ducks and pheasants, which are clothed in down at hatching, begin preening almost as soon as they are free of the egg. We make use of this behavior when rearing certain kinds of ducks and swans which do not readily feed under artificial conditions. We sprinkle crumbled hard-boiled egg yolk and starting rations on the backs of the newly-hatched ducklings and cygnets. In their frequent preening the birds cannot help but get some of this food in their bills and they soon learn that it is edible.

Young growing birds preen their new feathers constantly, worrying the splitting sheaths on their sprouting plumage. Adults aid their annual molting process in the same way. The molt for penguins brings on a preening orgy. Unlike other

birds, they molt their entire plumage at once. This is a period of great physiological strain and the molting bird becomes inactive and does not feed. Preening is its one constant activity as it works over its plumage, aiding in the gradual divestment of the old coat and the proper clearing of the new. I always marvel at the extreme flexibility of the bird neck when I watch one of our portly Emperor Penguins reach down and preen its leg feathers. I get the incredulous feeling of a spectator watching a circus fat man attempting to tie his own shoes.

Preening must be considered by the aviculturist when he makes up diets for his birds. For example, European Redshanks, which are slender, long-legged sandpipers, very much enjoy chopped fish. However, they fail to wipe their bills after eating and what happens when satisfied "Shanks" preens with a fish-smeared bill is not hard to imagine.

Members of the parrot family, especially love-



birds, are well known for their habit of preening each other. Actually, many birds indulge in mutual preening and, surprisingly, many of the invitational postures assumed by preening birds are common to very diverse groups. In one of the commonest postures, the bird bends the head downward and erects the feathers on the back of the head and upper neck — an area it cannot reach with its own bill. We have all seen parrots assume this position and trustingly offer their exposed necks to the powerful bills of their cage mates. Strange preening alliances frequently de-

velop in captivity. Our Indo-Malayan Exhibit houses a catbird-sized Black-headed Sibia which regularly preens with a sparrow-sized Blue-winged Siva — a rather touching picture. I once kept an incompatible pair of Red Birds of Paradise that nevertheless would preen each other with the utmost care during their brief truces. At first I shuddered to watch the aggressive female minutely attend the eyelids of her belligerent mate with her dagger-sharp bill. Actually, however, most birds, within a species, show a great respect for their fellows' eyes. Mutual preening plays a part in the courtship of some birds and seems important in the maintenance of the pair bond.

Another type of preening which has received a great deal of attention in recent years is so-called "displacement preening." The case of Messrs. Brown and Jones may illustrate the point. Imagine the following situation: Brown weighs 225 pounds while Jones weighs 115; Brown insults Jones; consequently, Jones would like to punch Brown in the nose, but he does not! Instead, he grits his teeth and digs his fingernails into his palms. Roughly speaking, Jones's teeth grinding and palm puncturing are displacement activities arising from his unsafe desire to punch Brown in the nose. Many birds faced with similar situations refrain from pecking or some other aggressive activity and preen instead. Displacement preening is often quite formalized and characteristic in a bird group. Last May, when I entered the Whooping Crane enclosure in the Audubon Park Zoo in New Orleans, where Crip and Josephine were feeding their two chicks, Josephine walked towards me. When I set up my movie camera near the chicks, she came closer and began preening her tertial feathers. Many a less distinguished crane had preened tertials at me in the past and I quickly recognized that Josephine would have liked very much to punch me in the nose! I moved back ten feet and she immediately stopped preening and went about her normal feeding chores. Birds newly introduced in group exhibits frequently engage in extended bouts of displacement preening. At first they are frightened and unfamiliar with cage peck order; however, an aviculturist who does not realize this may get completely erroneous impressions.

Still another situation is often seen in Birds of Paradise. Several in our collection seem to spend

time apparently arranging their plumes for proper display erection before engaging in a courtship display. Our Blood's Long-tailed Bird of Paradise has curiously-shaped tufts of feathers on either side of its breast which are normally concealed

A Scissor-tailed Drongo in a typical preening posture.



under the wings, but are erected over the head in display. When preparing to display, this bird uncovers these tufts and preens them carefully. It may be that there is some displacement action in this behavior, stemming from the bird's increasing urge to display.

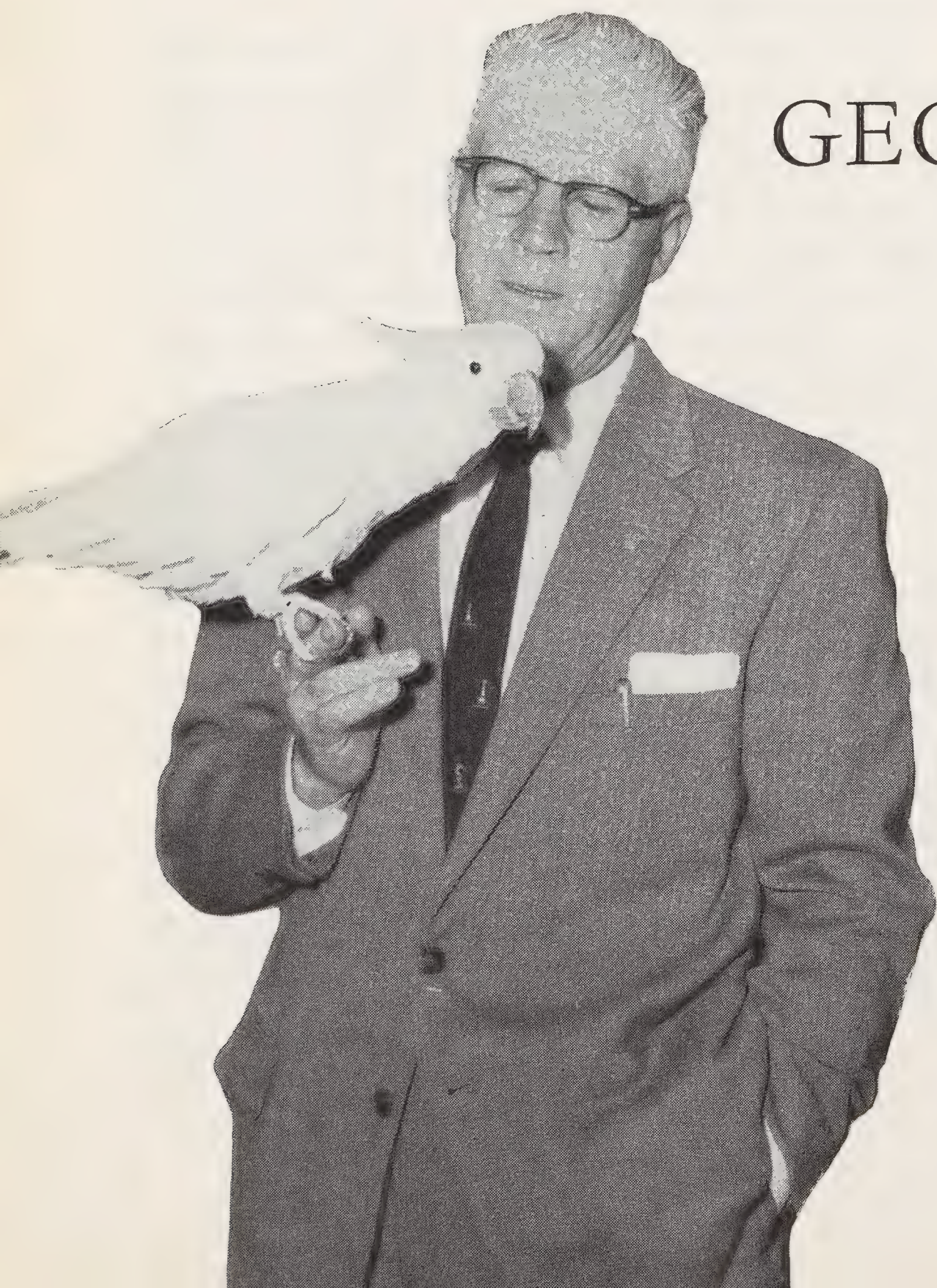
With the exception of ostriches, emus, rheas and some birds of several other Orders, birds are equipped with an oil gland near the base of the tail. Emperor Frederick II in his Thirteenth Century work on falconry commented on the oil gland and its possible uses. While the intervening centuries have shed much light on the significance of this gland, its full importance is not yet completely agreed upon. Birds do take oil from the gland and apparently dress their feathers and even their legs with it, and this is one of the most prominent of preening activities. There is an indication that the irradiated oil from the uropygial gland, ingested during preening, is a source of Vitamin D in some species. For many years the preening-oiling process was considered important as an aid in repelling water, especially in ducks. This subject is now more controversial, though I am inclined to feel this waterproofing function is a valid one. Some

ornithologists have even gone so far as to state that bird feathers have no oil in them. These "doubting Thomases" will profit from a trip to our Large Bird House and a visit to the Concave-casqued Hornbill. This huge hornbill anoints the white feathers of his crown and his white wing patches with so much yellowish oil that these areas become quite yellow. It has been suggested that this is a decoration and the areas so colored are prominent in threat postures.

Removal of the oil gland and then observation of the bird would seem helpful in determining the function of the gland. A number of such studies have been made, but the results are conflicting. W. H. Elder reports that ducks without oil glands developed plumage abnormalities, dry and cracked skin on their feet and legs, and dry, peeling bills. Unfortunately for the clarity of the situation, his birds' bills, feet and legs recovered by their third summer! James Fisher, in his excellent book, *The Fulmar*, states that this bird discharges waxy stomach oil when preening, and dresses its feathers with this oil. The Fulmar has a well-developed uropygial gland which it presumably uses as well. Mr. Fisher points out

that this tube-nosed species discharges oil through its nostrils while preening, and makes the interesting observation that tubular nostrils are found only in birds which produce stomach oil (such as petrels and albatrosses). He believes that tubular nostrils are an anatomical adaptation for preening.

One of the most intriguing feather-dressing adaptations is the powder down patch. These dense patches of down-like feathers grow continually, the tips breaking up into a fine white greasy-feeling powder. The powder is helped to permeate the birds' plumage during preening and herons are said to rub their beaks on the powder down patches. The purpose of the down appears to be waterproofing and insulation. I frequently noted, with a start, how thin and porous the plumage of a mounted egret feels. The live healthy birds' feathers feel dense and cohesive — almost sticky. This dense feeling seems to be due to thorough permeation by the greasy powder down. Dry-cleaning bills, on too many occasions, impel me to add that the aviculturist who incautiously handles a bird with powder down is likely to emerge looking like a worker in a flour factory.



Busier than ever!

GEORGE SCOTT

By LEE S. CRANDALL

WRITING AN ACCOUNT of the career of George Scott, our recently retired Head Keeper of Birds, is no ordinary task. For George is not an ordinary man and doing him justice, without risk of eulogy, presents a problem. It might be said, briefly, that he came to us in 1923, that he became Head Keeper in 1941, that he was a very good Head Keeper and we regret that retirement regulations ended his services to us on November 19, 1957. But that, of course, gives no picture of the man or of how he became

George Scott and "Cocky," an old friend.

what he is. Perhaps a factual, straight-forward story will not seem too filled with praise.

George Scott was born near Southampton, England, and spent his boyhood there. His reminiscences of those early days are replete with tales of his grandmother, a redoubtable woman who once carried a donkey across a stream because it would not walk. But she had her softer moments and it was from her that the young George learned to care for the birds that he caught with a tup'ny tin of bird lime from the corner shop. She taught him, too, how to rear the young starlings and blackbirds that, fallen from the nest, were in need of help. Such matters were common events in the lives of boys in the English countryside of those days but few had opportunity to apply to more serious purpose the knowledge they gained.

With the outbreak of World War I in 1914, George took to arms and soon found himself in France with Britain's "contemptible little army." His experiences as a Contemptible, sometimes hilarious, sometimes heart-breaking and always thrilling, were innumerable but through it all he came unscathed. After the war's end, in 1918, Scott shipped aboard a Cunarder as a steward and so passed several uneventful years. He might very well have continued in this service but for a curious coincidence.

For some time we had been planning an exchange of birds with the Zoological Society of London but shipment had been delayed for lack of a dependable caretaker for the week-long ocean voyage. It was then that the resourceful Sam Stacey, then our Head Keeper of Birds, had one of the best ideas of his long career. His niece had married a boy named Scott, who was a Cunard steward. The Scott boy had had some early experience; perhaps he could act as caretaker. We took the chance and it turned out that Scott not only could, but did — not once but several times. Never were trans-ocean exchanges carried out more successfully. When, in 1923, we needed a promising assistant keeper in the Bird Department, young Scott was our first thought. So it was that on May 14 of that year, our hopeful took up his new duties and soon was followed to this country by his wife, Georgina, and their small brood.

It must have been hard going for George in

those early days. Stacey was a strict task-master, a man of then unequalled experience, who knew exactly what must be done and how to do it. There was also the point that Scott was his niece's husband and there must be no hint of favoritism. But George was well trained in the necessities of discipline and applied himself to following instructions and learning as he went. When retirement ended the distinguished career of Samuel Stacey, in 1941, George Scott by natural succession became Head Keeper.

Our bird collections grew and prospered under Scott's painstaking care. Hummingbirds became a special interest and our continuing success with these delicate little creatures has been due entirely to his unflagging devotion to essential details. In 1949, when Charles and Emy Cordier were about to leave the Belgian Congo with their incredible living cargo, George Scott was dispatched to give them the help without which they could not have completed their successful mission. When Sir Edward Hallstrom, in 1953, offered to present to several American zoological gardens a marvellous collection of living Birds of Paradise, it was George Scott who was chosen for the difficult assignment. By way of Australia, he was flown to Sir Edward's station in central New Guinea, got his birds out only by the exercise of grim determination and ingenuity and finally came triumphantly eastward across America, dropping off Birds of Paradise at their destinations on his way, with not a single loss en route.

In the spring of 1957, with his sixty-fifth birthday and fixed retirement date looming closer, on November 19, George was making plans for the rehabilitation of the strawberry patch on a little farm in nearby Dutchess County. But all this was put aside to answer a call from the Federal Government for an aviculturist to supervise the rearing of the young Whooping Cranes it was hoped might hatch from the two precious eggs then being incubated by Crip and Jo in the Audubon Park Zoo in New Orleans. Strawberry patches might wait, but not young Whooping Cranes. So early in May, off went George to see what might be done to avoid past disappointments. On his return on August 6, he had left the world richer by two vigorous young Whoopers, then nearly as tall as their parents and the

first of their kind to be bred and reared in captivity. Long nights spent in nursing ailing chicks or fitfully sleeping on an army cot alongside the wired enclosure, were forgotten.

Plans for the farm again became foremost. But again they were set aside in response to the need for an expert to set up an aviary for the International Exposition to be held in Venezuela in 1959-1960. So on August 27, the Scotts were off to Caracas on a six months' mission. Accumulated time, vacation and terminal leave should

have released George from active duty in mid-June but his actual retirement date came and went with no cessation.

Sometime George Scott will return, leaving Caracas with aviary well stocked and personnel well trained. Sometime that strawberry patch will receive the attention it has lacked so long. But just when that time will come cannot be foretold, for while a good man may formally retire, he cannot completely disappear. Who knows what calls for help may come in the future?

News from the Conservation Foundation

Ten-Week Television Program Launched

The National Broadcasting Company, over Channel 4 in New York City and 29 Educational Television Stations throughout the nation, is presenting a ten-week television program entitled "Survival: The Story of Man, Resources and Civilization." Albert Burke, currently a member of the staff of our organization, has prepared the scripts and acts as host and narrator of this dynamic presentation of man's role in changing the face of the earth. In New York the series began on Saturday, November 23, and it may be seen on Channel 4 in New York each Saturday at 4:30 p.m. for ten successive weeks.

Research on Use of Pesticides

The Foundation and the New York Zoological Society have together sponsored an investigation by Dr. John L. George of the present state of knowledge of dangers in mass spraying to control destructive insects which from time to time threaten agricultural crops and forests. Dr. George's report indicates the need for far greater knowledge than now exists of the ecological effects of mass spraying, the controls that need to be used if spraying is found necessary, the question of immunization from spraying, the possibilities of alternative controls by the use of parasites, and the extent of damage to or destruction

of all forms of life. Further research will be sponsored by the two organizations within the coming year. In the meantime, the report recommends extreme caution and limitation of spraying until further knowledge is available.

Dr. Osborn Addresses American Foresters

On November 13 Dr. Fairfield Osborn gave the banquet address at the annual meeting of the Society of American Foresters at Syracuse. The title of his address was "Natural Resources and World Populations." He and Peter M. Stern also spoke before the Women's City Club of New York on November 19 on "Unplanned Use of Land throughout the World."

Expansion of Population Studies

In cooperation with the Population Council, plans have been made whereby Robert G. Snider will devote his full time in 1958 to expansion of the Population Study Program beyond the island of Jamaica to include Barbados and other colonies in the Caribbean. Mr. Snider has been responsible for the highly successful program now nearing completion in Jamaica. Its preliminary findings have proved so effective that installation of similar programs in other colonies in the near future appears probable. These programs aim to establish local committees of prominent private

citizens to present to the people of the islands, through interviews and meetings, the effect of too rapid population growth and the importance to individual human welfare of maintaining family size within the economic capacity of the family.

Industrial Use of Resource Technicians

A report on the findings of the first Industrial Conference, organized by Roger Hale of our staff and sponsored by the Foundation, will be published this fall. The conference, held at Ann Arbor, Mich., analyzed the need of various industries for resource technicians, the type of grad-

uate training available in American universities, and possible modifications in the type of training to meet the needs of industrial employers. The second conference, scheduled at Ann Arbor for January 13 and 14, 1958, will explore the personnel requirements of industries in connection with land-use planning and area development. Representatives of the National Planning Association, the Association of American Railroads and the Edison Electric Institute will participate with educators in the forthcoming conference. Increasing recognition of the responsibility of industry for wise resource development and use is encouraging.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

WHOOPING CRANES: THEIR STATUS NOW AND A PROGRAM FOR 1958

By **WILLIAM G. CONWAY**

WITH TWO CRANES reared in captivity this year, the Whooping Crane population is now the highest in seven years. The latest tally reveals one adult crane at the San Antonio Zoo, two adults and two young at the Audubon Park Zoo in New Orleans, and twenty-two adults and four young cranes wild on the Aransas Refuge, a total of thirty-one birds.

On November 15, as the body of the wild Whooper population settled down for the winter on the refuge in Texas, delegates from all over the United States and Canada came to the annual convention of the National Audubon Society in New York and listened to a discussion of the Whooping Crane's status. The speakers rose in turn to present their respective viewpoints about the captive or wild populations: George Douglass, Superintendent of the Audubon Park Zoo; myself from the New York Zoological Park; Daniel Janzen, Director of the Bureau of Sports Fisheries and Wildlife; and Director Maier of the Canadian Wildlife Service. John Baker, President of the National Audubon Society, expressed the Society's view.

Mr. Douglass gave an interesting review of the history of the captive Whooping Cranes in his care, as well as an account of their breeding. He praised the conscientious work of George Scott, the Bronx Zoo's Headkeeper of Birds (now retired) in the successful 1957 rearing program. Mr. Janzen discussed the loss of the wild King Ranch crane last summer. He noted that the bird, captured at the suggestion of the Whooping Crane committee with the expectation that it would become a mate for the San Antonio bird, had proved to be an extremely emaciated specimen. At its death, soon after it was captured, it was found to be a female. The San Antonio bird is also presumed to be a female. Mr. Janzen stated that there are no plans for capture of wild Whooping Cranes in the future for captive-breeding experiments. Mr. Maier described the Canadian nesting grounds in detail. He commented especially on the impenetrable nature of the area and discussed safety measures to preserve the region from molestation.

My own talk gave a picture of modern crane culture as now practiced in many zoos, and I ad-

vocated a breeding program for "Crip" and "Josephine," the Audubon Park birds, based on the most modern techniques. I pointed out that at least 14 of the 23 forms of cranes have been successfully bred in captivity. Six crane hybrids have been bred. Thirty-eight years (for a bird in the collection of Lady Lilford in England) is the longest recorded captive span for a Whooping Crane. One Whooper lived for nearly 24 years in the Bronx Zoo.

I expressed the opinion that the young cranes at Audubon Park Zoo should be separated from their parents no later than December, as the adults will become dangerous to the young with the commencement of a new breeding period. For the present, young captive-reared cranes should be pinioned to avoid the likelihood of injury should they attempt to fly in their enclosures. We know of no records of captive-reared cranes successfully breeding before their fifth year. While most cranes normally lay only two eggs each season, if these eggs are taken away as soon

as laid, the birds will usually lay another clutch. The Ueno Zoo in Tokyo has obtained as many as five clutches from a single pair of cranes in a single season.

Because of the many hazards associated with rearing the young cranes with their parents in a paddock, I advocated that at least the first clutch of eggs from the New Orleans birds be taken for artificial incubation and rearing. Such a program would allow us to hope that "Josephine" will lay a second clutch and thus the normal production of young would be doubled. This is not a new idea, but one that experienced aviculturists throughout the country have advocated. Mr. Douglass, who has done so much for the cranes already, visited the Bronx Zoo following the Audubon convention and discussed crane problems and the institution of the new program in 1958. He indicated his eagerness to attempt the artificial rearing program, so we may look forward to the most exciting Whooping Crane season yet!

Animal Census Reaches 1,001 Species on October 31

The routine monthly census of mammals, birds, reptiles and amphibians in the Zoological Park on October 31 revealed that we now have 1,001 species and subspecies — the first time the collection has exceeded the 1,000 mark in a number of years.

As nearly as we can determine from available records, the San Diego Zoo is the second largest Zoo in the United States in numbers of different kinds of animals, with 917 species and subspecies at the time of its mid-year census.

First Aid to Baby Kangaroos

The Animal Hospital has recently had two occasions to practice "veterinary pediatrics" by replacing baby kangaroos in their mothers' pouches. While this is not a rare occurrence, it is always an interesting one. The first baby was almost old enough to leave the pouch of its own accord — but not quite. It was found on the floor of the cage by a keeper, cold and almost lifeless, but fortunately rallied with the warmth and nourishment furnished in the pouch. The second was a new-

born infant approximately one inch long that had never been in the pouch; it was first seen while it was crawling on its mother and trying to find the opening of her pouch. Eventually it lost its hold and fell to the floor, but since it showed no sign of injury it was placed in the pouch and is presumably still there and thriving.

Closed for the Winter

By long custom, November 11 is closing day for certain of the Zoological Park's activities. When the Children's Zoo closed for the season, it had a recorded attendance of 325,340, some 30,000 more visitors than last year. The Farm-in-the-Zoo and Question House also closed for the winter on November 11.

Genetics Laboratory Gets Support from National Cancer Institute

For the tenth consecutive year the Genetics Laboratory of the Aquarium has been given a grant in principal support by the National Cancer Institute of the U.S. Public Health Service. The amount granted for 1958 is \$16,940.

Dr. Myron Gordon, the Aquarium's Geneticist,



"Olaf," the young Walrus at the Aquarium, swims on his back more often than any other way, and seems to enjoy an endless circling of the big Oceanic Pool. Astonished visitors like it, too.

was organizing chairman of the Fourth Conference on the Biology of Normal and Atypical Pigment Cell Growth held at the M. D. Anderson Hospital and Tumor Institute of the University of Texas Medical Center at Houston on November 14-16. A grant of \$7,000 was received from the Damon Runyon Memorial Fund in support of the conference.

Department of Tropical Research Off to Trinidad in December

The Department of Tropical Research starts its 59th Expedition in December. The coming season will be spent at Simla, in the Northern Range of Trinidad, B.W.I., with old problems continued and new projects initiated. Under a recent grant from the National Science Foundation, Dr. William Beebe and Dr. David Snow will work on ornithological problems, among which are the courtship of manakins and the habits of subterranean swifts. A new motion picture camera will be available and a tape recorder will be used to record the voices of birds. Jocelyn Crane will continue her investigations of butterflies. Henry Fleming will delve deeper into

the inter-relationships of tropical moths. The first of the season's guest investigators will be Dr. Anne Alexander of South Africa, who will study the behavior of *Peripatus* and Black Scorpions. — WILLIAM BEEBE

"Little Mambo" Now Weighs More than Sumaili

When Sumaili, our Mountain Gorilla, arrived from the Belgian Congo on May 15, 1949, she weighed only a trifle over 16 pounds — about the same as Mambo, our young Lowland Gorilla which came to us on May 15, 1951. By reason of her extra two years, Sumaili has been well ahead of Mambo in weight, so that we have long had the habit of referring to the young male as "Little Mambo." In the past few weeks, however, he is no longer little in relation to Sumaili.

At weighing time in mid-July, each animal weighed exactly 250 pounds. By September, Sumaili had managed to lose 10 pounds, as growing gorillas are apt to do, while Mambo had picked up 15 pounds. In mid-November, Mambo was well out in front, with 281 pounds, and Sumaili was trailing with 259.

Our young Giant Otter in the Small Mammal House has long since learned that Keeper Bergmann is a friend who brings him fish every day.



Mambo has not yet learned that he now has the size and strength to dominate his companion. Sumaili, now as for all the time since the two have been kept together in the Great Apes House, is the dominant animal. Her rule is never malicious, but it is firm and unmistakable.

Latest Research on Electric Eel Uses Micro-electrodes

For more than twenty years Director Christopher W. Coates of the Aquarium and associates from various hospitals and laboratories have been studying the Electric Eel and its extraordinary discharges, and gradually they are coming closer to a fundamental understanding of the mechanism of the production and discharge of the current. Recent advances are described by Mr. Coates and Dr. Mario Altamirano in the *Journal of Cellular and Comparative Physiology*. The article is concerned with the effects of potassium on the individual current-producing unit, the electroplax. Studies of what goes on in the electroplax—which is only about one millimeter wide—were made possible by the development of a technique for inserting several micro-electrodes into different parts of a single electroplax. Because the eel's electric organs operate essen-

tially the same as nerve tissue, they have become a valuable research tool and the importance of the continuing investigations lies less in explaining the functioning of the eel than in understanding the physiology of nerves in general, including those of man.

PUBLICATIONS OF INTEREST

THE GALATHEA DEEP SEA EXPEDITION. Described by Members of the Expedition. 296 pp., 240 illustrations, 1 folding map. The Macmillan Co., New York. \$8.00.

Not all the great scientific projects of recent years have been devoted to atomic bombs, earth satellites or human diseases. In 1950, the Danish sloop *Galathea* set out on a two-year journey around the world to explore the depths of the sea—a trip that has already taken its place among the leading scientific expeditions of all time. Its primary object was to discover and study what life exists two and a half miles or more below the surface of the ocean. To that end the ship was equipped with a powerful winch and nearly 7½ miles of heavy wire, as well as other special apparatus, some of which was designed specifically for the occasion. With this equipment the *Galathea* was able to probe 6½ miles into one of the deepest parts of the sea and to bring to the surface two species of worms, a clam, a sea-cucumber and an anemone, in addition to abundant bacteria. We now know that life extends to the very depths of the ocean where pressures are more than a thousand times greater than those at sea level.

Deep-sea operations were only one phase of the intri-

cate program of the *Galathea*, however, and this book describes the planning and execution of them all. Although no serious mishaps marred the expedition and most things went as planned, there were many occasions when excitement ran high. Few books have so authentically portrayed the thrills and satisfactions of scientific discovery. — J. W. A.

ANTARCTIC HAZARD. By W. Ross Cockrill. 230 pp., 21 illus., map end-papers. Philosophical Library, New York, 1957. \$4.75.

Veterinarians who go whale-hunting are seemingly a special breed — good writers as well as professional men. Robertson, who wrote "Of Whales and Men" a few years ago, was a veterinarian; so is Cockrill, the author of this exciting and literate book. Cockrill's job was to advise on the production of whale meat for human consumption in the British market. It was a losing game, but it produced an entertaining and informative book. — W. BR.

HANDBOOK OF SNAKES OF THE UNITED STATES AND CANADA. By Albert Hazen Wright and Anna Allen Wright. Two Volumes, 1106 pp., 306 illus., 70 maps. Comstock Publishing Associates, Cornell University Press, Ithaca, New York, 1957. \$14.75.

Publication of this long-awaited work is a notable event for North American herpetology, the authors and the publishers. These volumes complete the series of Comstock handbooks on the major groups of amphibians and reptiles of the United States and Canada, a series initiated by the Wrights and produced under the editorship of Dr. Wright. Thanks to their diligence and hard work, herpetologists now have a complete set of reference books covering the natural history, characters, habits and distribution of every salamander, frog, turtle, lizard and snake in the area covered — and virtually every form is illustrated by black and white photographs taken in life.

In the United States and Canada as a whole there are more different kinds of snakes than of any other reptiles or amphibians, and thus two volumes were necessary to cover the pertinent information. This has some disadvantages but permits the inclusion of more material. For each snake the topics are arranged as follows: name of snake; geographic range, including a list of states and elevations; size; length of life; distinctive characteristics; color; habitat; period of activity; breeding, including information on eggs and young; ecdysis; food; venom; enemies; field notes; and authorities. The last named includes references to herpetologists who have published observations on the animal in question. For some topics the mass of detail is a distraction and further summarization would have been desirable. However, the Wrights' aim was to make their accounts complete and in this they have attained a high degree of success. These two volumes are sure to be used constantly by anyone interested in information about our native snakes. All naturalists owe the Wrights a great debt of thanks for their copious and valuable contributions to North American natural history — J. A. O.

TREASURY OF SNAKE LORE. Edited by Brandt Aymar. XVI + 400 pp. Greenberg: Publisher, New York, 1956. \$5.00.

"The snake is a wondrous creature. He has fasci-

nated, frightened, inspired his own worship, symbolized all the evil in the world, and aroused the curiosity of mankind ever since things began. No wonder he has captured the imagination for better or worse, of writers of all ages and all nations." With this idea in mind, Brandt Aymar has brought together in this book some of the literature, prose and poetry, factual and fictional, that has resulted from the impact the snake has made on mankind. Most of the works included here have been selected for their literary rather than their scientific qualities. They are grouped in selections from a wide variety of sources from the Bible, mythology, fable, serpent worship, essays, short stories, mystery stories, tall tales, selections from novels, accounts of personal adventure, drama, an account of the Hopi Snake Dance, and a number of poems. The role of the snake varies in the different selections. Anyone interested in reptiles, general natural history or just interesting reading, will find much pleasure in this volume. — J. A. OLIVER

FISHES OF THE WORLD. Edouard Le Danois and others. 190 pp., 118 photographs in black-and-white, 30 in color, 7 sketches. The Countryman Press, Woodstock, Vermont. Distributed by A. S. Barnes & Co., New York. \$12.50.

A good introduction sometimes makes all the difference, since it can permanently influence one's reactions to a person or subject. For this reason, if no other, experts in fish and fisheries should be pleased with this beautiful book. It is hard to imagine anyone not being captivated by fish as they are described in the author's vivid style and depicted in the book's magnificent photographic reproductions. More than a third of the black-and-white photographs were taken from the files of the New York Zoological Society and illustrate specimens once on exhibition at the New York Aquarium. We have never seen them reproduced so well. Those who know their fishes, however, will be perplexed by the gross, inexcusable errors that mar the captions for several of the illustrations. — J. W. ATZ

LIVING REPTILES OF THE WORLD. By Karl P. Schmidt and Robert F. Inger. 266 illustrations, 145 in color. 287 pp. Hanover House, Garden City, N. Y., 1957. \$10.00.

This is a splendid book about reptiles. The text is interesting and informative; the illustrations are excellent for the most part. Unfortunately, as with almost all other good things today, the price is too high. This will keep the book out of the hands of many of the young naturalists who will covet it.

Until his sudden death just before publication of the book, Karl P. Schmidt was Curator Emeritus of Zoology at the Chicago Natural History Museum; Robert F. Inger is Curator of Reptiles at that institution. Both are recognized authorities in herpetology.

The book deals in general terms with the living reptiles of the world, taking them up in order: turtles, the Tuatara, crocodilians, lizards and snakes. Within each of the major groups or orders, each of the separate families is considered and several representative species are discussed. The treatment is primarily systematic and emphasis is placed on the evolutionary adjustment of the modern forms, with frequent references to natural history or relations to human beings. The authors have been highly successful in condensing a vast amount of information into a relatively limited text. — J. A. OLIVER

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Concluding remarks made by President Osborn in his address before the Annual Meeting of Members of the Society at the Waldorf-Astoria, January 8, 1958.

How impossible, indeed how unnecessary, for me or anyone, to epitomize the meaning of our Society. You here tonight, numbering almost two thousand people, need no definition for you are here because nothing else in the world gives you a satisfaction equal to that of contact with the wonders of animal life. Nor do the almost three million people who come to the Zoo and the Aquarium each year need such a definition.

No one human interest is exclusive or even paramount. There are the imperatives of spiritual belief. There are the enjoyments that come through the arts. There are the accomplishments that come through the development of the physical sciences. Yet one thing is certain — the thirst among great numbers of people for a contact with nature through the observance of these wonderful creatures — their beauty, their self-containment, their mystery, sometimes their humor, sometimes even their apparent humanness — these animals of the land and of the sea — the thirst that people feel for nearness to them is unquenchable. It is the work and endless destiny of our Zoological Society to be the medium through which this thirst, this desire of innumerable people, can be satisfied.

Fairfield Osborn

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

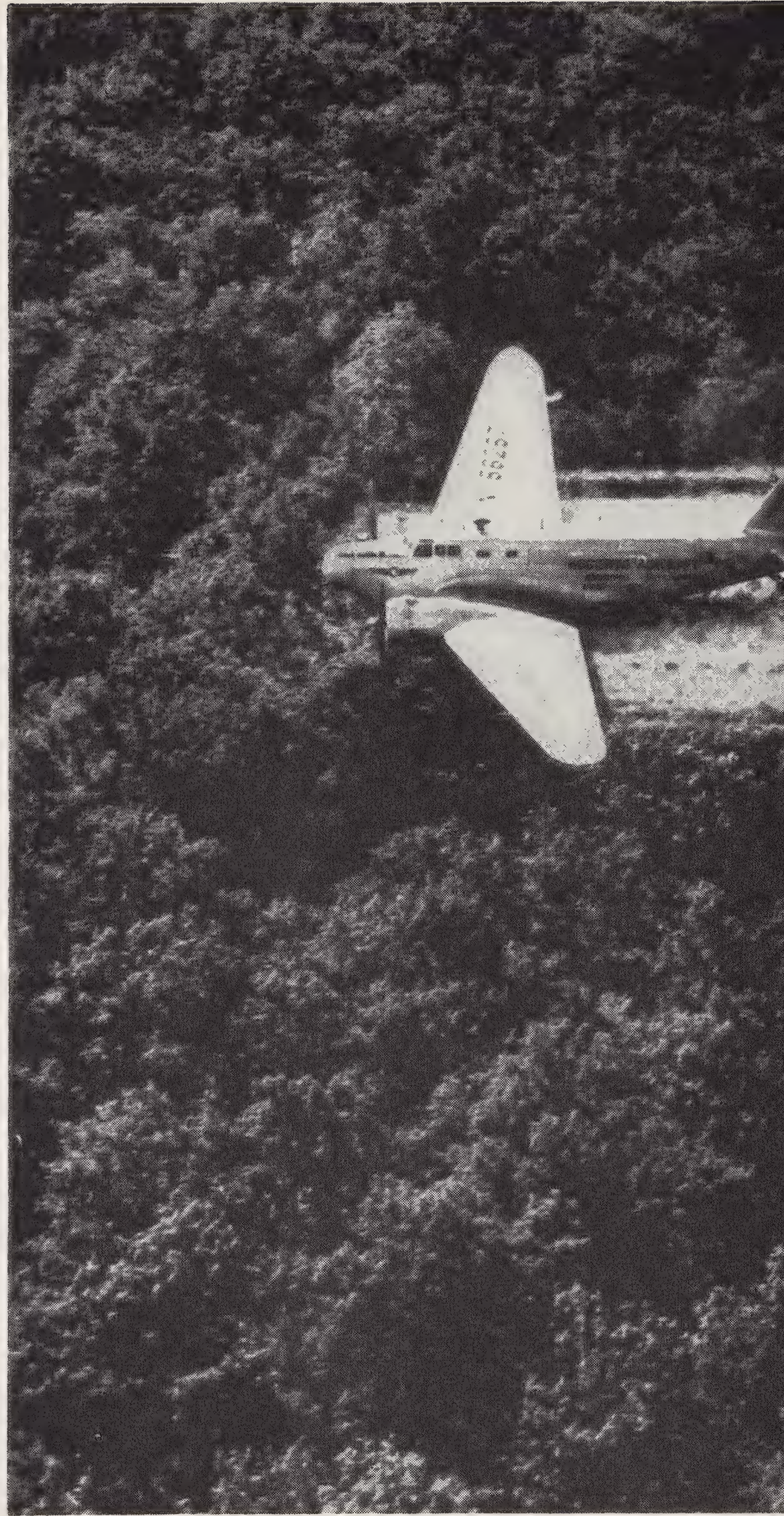
It's High Time We Solve THE PESTICIDE PROBLEM

By JOHN L. GEORGE

ONE BATTLE of World War II is still being waged — DDT and other chemicals against the insects. This battle will probably never end, because of the nature and multitudes of the enemy. There are more insects than all other forms of life, plant and animal combined, and they have had millions of years of experience with toxic compounds. Thousands of plants have produced toxins that poison insects.

DDT was man's most sensational weapon against insects since the fly swatter. Apples were wormless, crop yields jumped, insect-borne diseases were beat back and sun bathers could bake without slapping. However, the insects found a way to become immune to DDT and so other chemicals were manufactured to knock them down: BHC, dieldrin, TEPP, toxaphene, malathion, etc.

Before the war the United States spent \$40 million annually to combat insects and other animals and plants. Last year the amount was \$290 million, and the prediction is that within a decade



or two the figure will reach the billion-dollar mark. This money is being used to control "pests," and the chemicals are therefore called "pesticides." Unfortunately, almost every animal or plant has been classed as a pest by someone at some time.

Tons of pesticides have been dumped on our farm lands, forests and swamp lands, and as fast as the insects adjust to them, the chemists think up new ones. In the race to outwit the ancient ability of the insect to adapt, there has been little time to find out what this assault is doing to the plants, animals and environments.

No one disputes the toxic nature of these



Multi-engined planes are used to spray a DDT-oil solution over an area infested by the gypsy moth. The insecticide remains effective for at least three weeks. At the right — leaf-eating caterpillars of the gypsy moth. These do great damage to our forests.

*Both photos:
Agricultural Research Service, USDA*



tivity of the chemist and the pesticide industry.

The biologist, racing to catch up, is trying to find out what happens to laboratory animals, fish, wildlife, domestic animals and human beings and their environments, when dosed with economic poisons, so that he can at least predict what is a lethal dose. The effects of the lethal dose are obvious, but the effects of a sub-lethal dose, which is almost as important, requires a most detailed study over many years. The biologist has not had time to study thoroughly even one of these chemicals. There is practically nothing known about the effects of small doses of any of them on the functioning of the vital organs of living creatures. Many facts have been discovered but no generalizations are possible, because our knowledge is so fragmentary. We could get by with this fragmentary knowledge if the use of pesticides continued to be limited to one orchard here, a beach there, an infested area of a forest somewhere else. But when vast areas are being swept with these chemicals, then it is time to really launch a re-

chemicals to all forms of life, but it is hard to determine what BHC is doing today when dieldrin will be used tomorrow and another chemical the next day. The studies of the effects, both short range and long range, lag far behind the produc-

search program and know what we are doing.

We are not sure what happens to the biotic balance on an area sprayed once, not to mention four or forty times. It would take a crew of biologists, ornithologists, mammalogists, herpetologists,



Above — A much-enlarged picture of the winged, fertile queen of the fire ant which is spreading in the southeastern states.

*Both photos:
Agricultural Research Service, USDA*

Tunnels in a fire ant mound that has been cut open. These runways swarm with thousands of the biting, crop-devouring ants.

ichthyologists and entomologists, as well as soil experts, to pursue this complicated investigation. Until this is done no one can come to an enlightened evaluation of the worth of these chemicals.

However, what knowledge we do have of their effects upon wildlife is enough to make us seriously question certain programs. Recent studies have shown that 1/200,000th of an ounce of dieldrin per day for a two-month period will cause pheasants to produce eggs of reduced hatchability and chicks that are subject to a high death rate. There are, in addition, indications that these weaknesses will persist in the few remaining young even though they receive no toxins. This is not a pleasant picture. Even one-fifth of this amount produces similar effects in the Bob-White Quail.

Another study indicates that at two pounds of dieldrin per acre there will be enough poison in one square foot to kill two adult Bob-White Quail or twenty chicks — and there are 43,560 square feet in an acre.

Dieldrin, along with heptachlor, is the chemical that is being used in the control of the fire ant in the southeastern United States. The fire ant apparently was introduced from South America via Mobile, Alabama, some thirty-five years ago. It has since spread to ten southeastern states. It causes wide damage to pastures in that it riddles them with many large mounds. It also bites people and livestock, and eats certain crops. It is a pest! A control program has been launched by the U. S. Department of Agriculture to eradicate it. Twenty million acres will be treated at the rate of two pounds or more of dieldrin or heptachlor per acre.

All available information indicates that this concentration will cause widespread elimination



of wildlife. Birds will certainly be hard hit. Mammals, too, will be decimated in the treated areas. Studies in California showed that applications of 0.5 to 1.5 pounds per acre caused the death of rodents and rabbits. Cold-blooded creatures are much more susceptible and virtual elimination of these forms in the treated areas can be expected.

There are further complications in that many other insects besides the fire ant will be affected by the treatments. The full effects of the pro-

gram cannot be predicted. Several entomologists have suggested that the upset in insect populations as a result of the program will create new pests, as their normal predators will be eliminated.

This possibility is very likely, as the only real control of insect populations at the present time is being done by other insects and disease. Biological control, by manipulating insect populations and culturing specific disease organisms, is a promising field which has not been given a full opportunity to demonstrate its potentialities. Very often introduced insects are troublesome because they no longer have the normal controls which kept them in balance in their native lands. A study of their normal parasites, predators and diseases which attack them there usually enables us



to introduce a few which will cheerfully carry on their work for us in this country.

The use of pesticides is being studied by the New York Zoological Society and its affiliate, the Conservation Foundation. After many discussions of the problem by the staff and officers of our two organizations, it would seem that we can play an important and needed role in contributing to the formulation of an impartial objective judgment concerning pesticide use.

Many workers in the field of insect control have asked us to compile the known facts, evaluate the merits and disadvantages of pesticide use, and on the basis of what is known, advise the American people. The Society and the Foundation are in an ideal position to do this. Whereas we are dedicated to the protection of wildlife and natural environments, we are also concerned with the problem of increasing productivity of our resources through management so as to raise the general welfare of the world's people.

If pesticides can be used without endangering fish and wildlife, wild environments and human health, our societies will welcome them. If, on the other hand, their use gives only temporary advantage while poisons accumulate in our soils and living creatures and the insect targets become immune, then we must make every attempt to oppose them.

Whatever the answer, we still don't have it. But we *must* get it.

This picture indicates the size of the mounds built by fire ants. They are most common over open areas such as cultivated fields and pastures, parks, lawns, meadows. They are a pest!

Photo: Agricultural Research Service, USDA



Most Beautiful of All - -

The Turquoise-browed Motmot

By ALEXANDER F. SKUTCH

UNLIKE THEIR RELATIVES the kingfishers, which are of almost world-wide distribution, the motmots are confined to the mainland and closely adjacent islands of tropical America. With their softly blended colors, set off by bright markings on the head and foreneck, they are lovely birds, and their beauty is enhanced by their peculiar tails, which in most species have the central pair of feathers far longer than the outer ones. These central tail feathers have a length of naked shaft which ends in a racquet-like expansion, so that their terminal portion seems to be joined to the more basal part by a stiff wire. The central tail feathers do not grow out of the body in this peculiar form, but at first they bear vanes throughout their length, although they are often somewhat narrower just behind the terminal expansion. In this region the barbs which form the vanes are loosely attached, so that they readily wear away, or break off as the motmot preens its tail feathers, until only the central shaft remains. It is probably not true that the motmot deliberately undertakes to adorn itself by trimming its tail, but the structure of the feathers makes this result inevitable. These distinctive tail feathers facilitate the recognition of the typical motmots.

Although South America is the headquarters of many of the families of birds peculiar to the New World, including tanagers, toucans, puff-birds and jacamars, the motmots belong pre-eminently to Central America and tropical México, where most of the eight species which make up this small family are to be found. I spent nearly a year travelling widely in Perú, Ecuador and Colombia without meeting a single motmot. But in the lowlands of northern Central America





Left — A Turquoise-browed Motmot in our collection, showing the tail vanes stripped. Above — The Tela river in the Caribbean lowlands of Honduras. Motmots nested in the banks along this shallow river.

Upper photo by the author.

and southern México, no one with an eye for birds can go far without seeing these beautiful creatures and falling under their spell. They are especially prominent in the hot, arid regions, in part because the sparse vegetation provides relatively little concealment, in part, no doubt, because they are actually more abundant than amid the heavier growth of the humid lowlands. Of these motmots of dry or deforested country, the most widely distributed is the Turquoise-browed (*Eumomota superciliosa*) which ranges from northwestern Costa Rica and eastern Nicaragua through the lowlands of both coasts to Oaxaca and Veracruz in México.

I may be prejudiced in favor of the Turquoise-browed Motmot because it was the first member of the family that I knew intimately, but in my opinion it is the most beautiful of all the motmots. It owes no small part of its outstanding

loveliness to its tail, which has the vaneless portion of the shafts much longer than in most other species, and this imparts to it an airy grace beyond that of its relatives. The softly blended colors of its plumage, subdued greens, blues and rufescent browns, seem to have been applied with pastels rather than enamels. Its brightest color is the broad band of exquisite turquoise which arches above each eye, bordered on the lower side by a black stripe passing through the eye. On its foreneck it wears, as a sort of badge or insignia, an isolated patch of black bordered on each side by turquoise blue. Its strong, broad, black bill is provided with fine serrations which give it a surer hold on its prey. As in the allied kingfishers, a single toe is directed backward, and of the three forwardly directed toes the outer is joined to the central for much of its length.

The Turquoise-browed Motmot is an inactive bird, resting motionless for long periods, in the shade of a thicket, on a bough overhanging a stream or, in the banana-producing districts of northern Central America, on a telephone wire beside a railroad track. Here, if the observer re-

frains from approaching too closely, he may admire at his leisure the lovely plumage suffused with morning sunshine. From time to time the contemplative bird sways its long tail from side to side like a slowly swinging pendulum, and often it is held tilted sideways. When the motmot executes a sudden about-face, it carefully twitches its tail up and over the perch with a graceful flourish that saves the plumes from abrasion.

Their habitual immobility has earned for the motmots as a family the designation *bobos* (fools) in Spanish-speaking countries, but their only folly is the avoidance of unnecessary exertion in a hot climate. Although the turquoise-browed bird much of the time appears immersed in a trance, it has not severed contact with the outer world. Nothing that moves in the circle of its vision seems to escape its large brown eyes. With surprising suddenness it breaks its long period of immobility with a rapid forward dart, perhaps to pluck a green caterpillar from a green leaf a dozen yards away. Returning to its perch, it beats its prey resoundingly against the branch before swallowing it. One sometimes hears the loud whacks coming from a thicket where the motmot rests unseen. Its diet includes beetles, caterpillars and other insects, as well as spiders, worms and small lizards. Often it overtakes winged insects in the air, in the manner of a flycatcher. Motmots and jacamars are among the very few birds which habitually prey upon the larger and more brilliant butterflies.

The motmots' flight is swift and undulatory but rarely long sustained. Unfortunately they have not, like the orioles, voices as lovely as their plumage. Rather silent through much of the year, with the onset of the mating season in March they frequently call *cawak cawak*, almost invariably twice together, or sometimes a single, long-drawn *cawaaalk*, all in a deep, throaty voice, as though they talked with a full mouth. In the scrubby thickets, male and female call to each other in their thick, lustreless voices, rest motionless side by side on the same branch, and at intervals fly down to examine the banks where they will soon dig their burrows.

In country underlain by porous limestone, as much of the Yucatán Peninsula is, the Turquoise-browed Motmots are said to nest and to pass

much of their time in caverns, grottoes and wells, laying their eggs in suitable crannies in the pitted walls. In the regions where I have studied them, such subterranean retreats are not available and they excavate their burrows in banks, much in the manner of kingfishers. In some of the dry interior valleys of Guatemala where cacti and thorny scrub form the dominant vegetation, as along the middle reaches of the Río Motagua, the walls of barrancas and escarpments on the barren hillsides are perforated by many tunnels, apparently made largely by this species and the equally abundant Russet-crowned Motmot. Nearer the coast, where the magnificent rainforest is tall and heavy and clearings left by the shifting cultivation are rapidly overgrown by lush, impenetrable thickets, the Turquoise-browed Motmots nest chiefly in the banks of streams at the season when the current is low, although they also take advantage of the sides of railroad cuttings and similar vertical exposures of soil. If an extensive area of tangled second-growth vegetation, such as they favor in this region, contains few suitable nest sites, a number of pairs will perforce breed close together. I remember a railroad cutting where seven pairs dug their tunnels within a few yards of each other and proceeded with their nesting despite frequent interruptions by pedestrians and the noisy passage of an occasional train. But where river banks provide an abundance of nest sites, each pair prefers to rear its family at a distance from its neighbors.

When I found my first motmots' nest in the bank of a Honduran stream, it already contained eggs. With a view to following the course of events, I carefully uncovered the chamber, then equipped it with a glass roof protected by a wooden lid. But the motmots would not tolerate such extensive alterations to their burrow. They abandoned their nest and three days later set about to excavate a new tunnel in a neighboring part of the bank. I was not displeased with this unintended result of my interference, for it provided an opportunity to study the motmots' nesting operations from the very beginning. The sexes were alike in plumage, and at first I could not distinguish the male from the female. But when one presented an insect or a spider to the other, I made the assumption that the attentive one probably was the male, and by a disarranged

feather or a dust spot on the plumage, I could then distinguish the twain for brief periods, despite their changes in position.

It soon became evident that although both sexes participated in the labor of excavation, they did not take equal shares, but the female did most of the work. Each time she entered the boring she kicked vigorously, using her short legs alternately and sending back two intermittent, parallel jets of sand, which at first shot out of the tunnel but fell short of its mouth as they followed her inward. Apparently she used her strong bill to loosen the earth at the head of excavation, then gradually kicked the soil outward each time she returned to her task, for she never moved back to the entrance pushing the loosened material before her. After two to eighteen minutes in the burrow she emerged and flew to perch in a willow tree beside her mate, who after a few minutes flew in turn to the excavation, such alternation at the task of nest building being the rule in motmots, kingfishers, jacamars, woodpeckers, trogons and many other hole-nesting birds. But the male's spells in the boring were much shorter than his mate's, and sometimes instead of getting along with the work he would delay in the doorway, scratch a little with his feet or peck with his bill, look around at his partner, kick out a little more earth, look around again, and finally fly back to perch beside her without having accomplished anything of account. It certainly seemed that by his symbolic digging and his gifts of food he was coaxing and encouraging the female to intensify her efforts, without doing a fair share of the work himself. Of course, since I could not identify the sexes except by their conduct, it is not impossible that the male motmot was the earnest toiler, the female the food-giver and the coaxer, but this is unlikely.

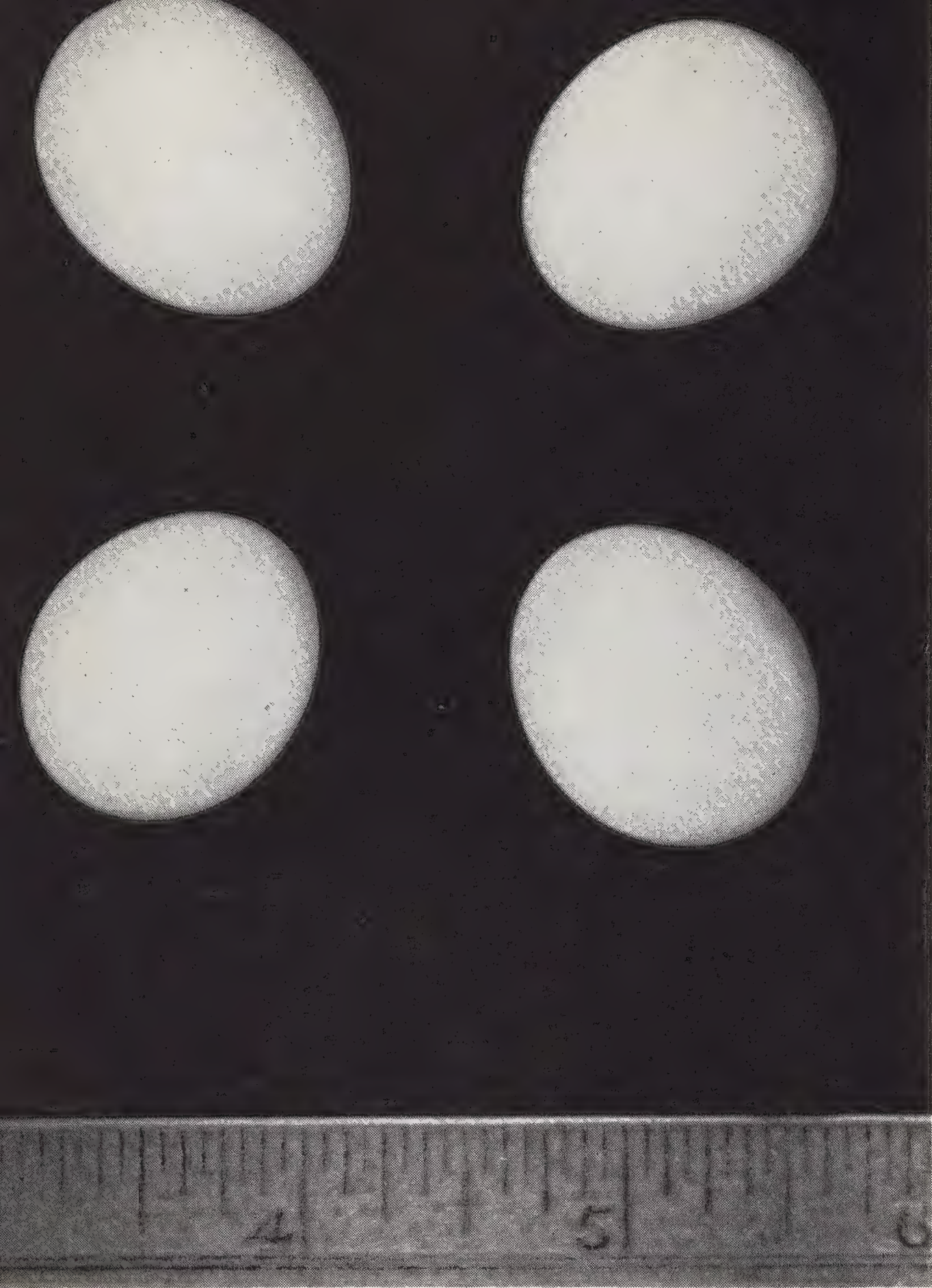
The motmots worked a long day, continuing until about five o'clock in the evening, and on some days they lengthened their tunnel by as much as fifteen inches. At first they backed out tail first after each spell of work, but after four days they emerged head first, indicating that they had now made an enlargement which permitted them to turn around. This expansion at the inner end of the tunnel was the chamber where they would lay their eggs and rear their young. In somewhat less than five days these two birds

had dug a burrow five feet two inches in length. Despite their prolonged subterranean labor, their beautiful plumage looked as fresh and clean when they finished their tunnel as when they began it.

Four other burrows that I measured were between fifty and sixty inches in length, but burrows up to eight feet long were long ago found by Robert Owen in Baja Verapaz, Guatemala. The shortest of my burrows, only forty inches in length, was made in peculiar circumstances. A pair of motmots had begun to tunnel near the top of a low stream bank, from the edge of which the ground sloped down on the landward side, so that before long they found themselves digging out into the light and air. One can imagine their surprise and disappointment. But they lost no time in starting a second burrow near by, and since the season was now far advanced and the female's need to lay was evidently pressing, they contented themselves with an unusually short tunnel. This was so straight that from the mouth I could look right into the expanded chamber at the inner end. Most burrows curve gently to the right or left, so that the brood chamber cannot be seen from the front.

The motmots take no soft lining into their burrow but deposit their eggs on the earthen floor of the nest chamber. The set consists usually of four, but sometimes of only three, short, blunt, pure white eggs, which in the Caribbean lowlands of northern Central America are laid chiefly in late April and early May, when the rivers are low. Both sexes incubate, each sitting for an hour or more until relieved by its mate. The partner arriving to take its spell on the eggs perches above the entrance of the burrow and calls in a low voice until the other comes out, so that only one is within at a time. While sitting in the nest they continually regurgitate the shards of beetles and other hard, indigestible portions of their food, until at length the accumulated ejecta are compacted into a firm floor beneath the eggs and young.

At the short tunnel made by the pair that had earlier dug out into the sunlight, I could look in and see the motmot sitting on the eggs, but of course I could learn its normal position while incubating only by stealing up in the night while it was asleep. My first nocturnal visit brought me a



great surprise, for when I directed my electric torch into the tunnel its rays picked out a creature unfamiliar to me. A gray, furry animal had entered the burrow and slept there, probably digesting the eggs it had eaten! Such was my first startled impression, and only by noticing the turquoise on its brow and the blue on its wings could I convince myself that a motmot was present, slumbering peacefully on its eggs. Its body plumage was fluffed out so loosely, and its subdued colors were so transformed in the yellow artificial light, that it seemed to be clothed in fur rather than in feathers. The motmot, whose sex I could not learn, slept with its head inward and its long tail running straight forward into the tunnel, and in this orientation I found it on all my subsequent visits. Thereby it avoided bending its tail while it sat for long hours, and it preserved its ornate racquet-feathers clean and unbroken while performing its parental duties.

Because the motmots so readily deserted burrows which I prepared for study before they had finished laying, I could not determine the exact

length of the incubation period. One set of eggs, which I reached while they were still so fresh that the yolk showed through the translucent shell, hatched seventeen days later. But the full incubation period may well be a few days longer than this, for in the Blue-throated Green Motmot it is twenty-one days.

The newly hatched motmot bears not a trace of down or feathers on its pink skin. Its eyes are represented by prominent protuberances on the sides of the head. It peeps in a weak, hoarse voice. Soon after emerging from the shell it can hold itself erect, standing on its heels and supporting most of its weight on its swollen abdomen. Although its eyes are tightly closed, it is already sensitive to light, and if the rear of the nest chamber is opened it shuffles, along with its brothers and sisters, into the entrance tunnel, where it is difficult to reach. Both parents brood the nestlings and nourish them with brilliant butterflies, green mantises, caterpillars, many small



insects of diverse sorts, and lizards up to six inches in length. The attendants are most wary about entering the burrow, often delaying for many minutes on a perch some distance in front of it, holding the food in their bill and knocking it briskly against the branch as long as it continues to struggle. Inside the burrow, the soft parts of the lizards are somehow extracted from the skin, which is then allowed to lie on the floor until it decays. Since motmots give no more attention to their nest's sanitation than kingfishers and no waste matter is ever removed, the nursery chamber soon becomes infested with maggots and is disgustingly foul.

The young develop slowly and are about a week old before their eyelids start to open and their pinfeathers to push through the skin. At the age of twelve days they bristle with the long pinfeathers, from whose tips the plumage is beginning to emerge. When about twenty days old they are decently clad in feathers. They are now most difficult to remove for examination, for when their chamber is opened at the rear they retreat into the middle of the tunnel, beyond reach of either end. Sometimes by shining a light into the front of the burrow they can be driven back within reach. When they are from twenty-five to twenty-nine days old and can fly well they come forth into the outer world. They now closely resemble their parents in coloration, although their tails are far shorter and still lack the racquet-like tips. However, while perching the youngsters already sway them from side to side in the manner of their elders, at the same time making indescribable throaty noises which bear a recognizable resemblance to the adults' calls. Although their bills and feet are often caked with dirt, their plumage is as fresh and neat as if they had grown up in a nursery that had been kept scrupulously clean. One marvels

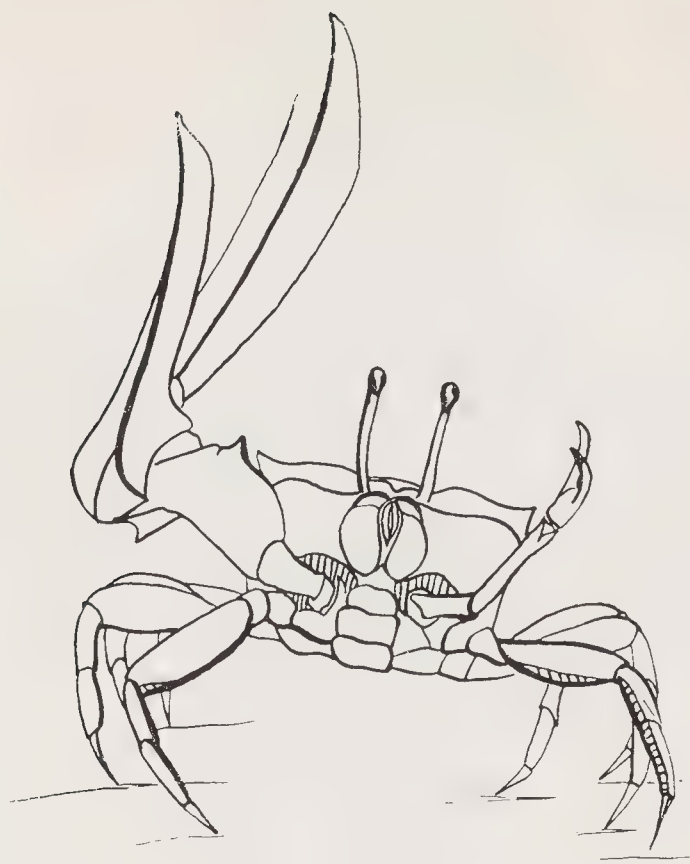
that such loveliness should have come into being in a putrid hole in the ground.

I have never had the good fortune to surprise them trimming their tails. But I am sure that the vanes are not merely worn away from the subterminal portion of the shaft as the birds move through dense vegetation, as some have imagined, for the denudation of the shaft begins while the central feathers, which alone undergo this transformation, are no longer than the lateral ones, so that they are shielded by them from contact with surrounding objects. In early June I found a young motmot, still attended by its parents, whose central tail feathers projected only an inch beyond the others, yet the shafts were already naked for a short distance above the terminal racquets. On another occasion, at the beginning of the breeding season, I saw an adult motmot, apparently just completing its molt, whose central tail feathers did not project at all beyond the lateral ones, yet the shafts were already vaneless for at least a short distance. Thus in the Turquoise-browed Motmot the falling away of the vanes begins long before the central tail feathers have reached their full length, and I have never seen an individual with fully grown feathers which did not have a long stretch of naked shaft. But in other motmots, such as the Broad-billed and the Blue-diademed, the central tail feathers reach nearly or quite their full length before denudation begins; and in these the vaneless portion of the shaft is always far shorter than in the Turquoise-browed Motmot.

Upper left — Eggs of the Turquoise-browed Motmot. A set usually consists of 4, and they are pure white. Left — A nestling 12 or 13 days old. Below — All four eggs hatched; the babies are now 20-21 days old.

All photos by the author.





Little Crab with a Big Empire

By JOCELYN CRANE

THERE IS ONE SPECIES of lively fiddler crab that thrives on every suitable shore from the South Pacific islands throughout the East Indies and on to the edge of the Red Sea. That distance measures almost half way around the world — a big empire for a two-inch crab with turquoise spots and crimson legs.

Because of the success of this crustacean and its relations, I have visited many tropical coun-

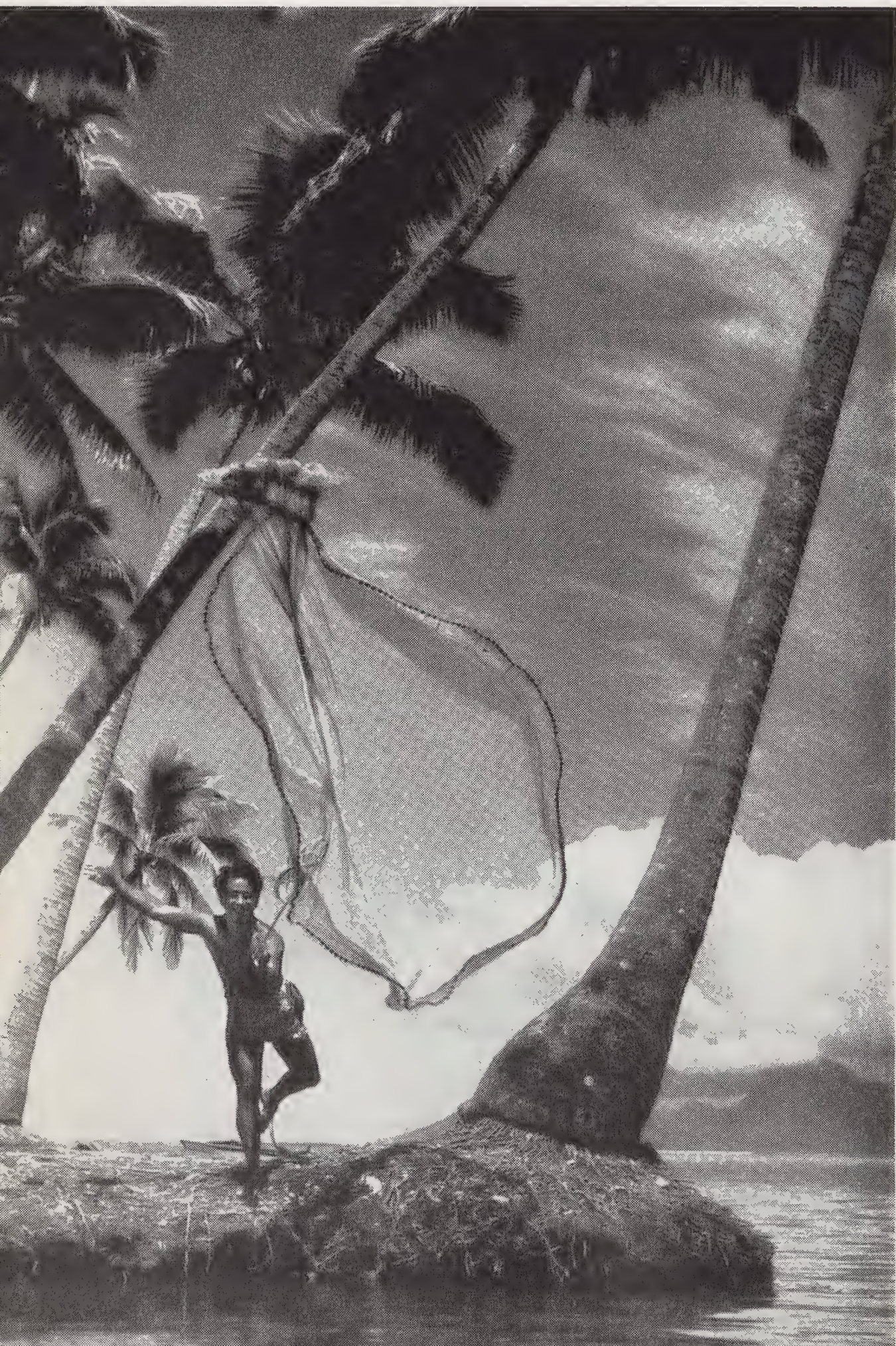
tries during the past three summers, comparing fiddler habitats and behavior, photographing their dance-like displays and collecting specimens for laboratory study at home. Thanks to these wanderings of my own I can appreciate as never before both the size of our world and the accomplishments of the crabs; not only have they spread widely around the globe, evolving through the ages into many different species, but a few far-ranging kinds preserve their characteristics unchanged, even to the patterns of their dances.

Although the name of the most widely ranging fiddler is *Uca tetragonon* I started thinking of it as the "Shaker" as soon as I saw its display. The species belongs to a rather primitive part of the genus and the great claw does not make the beckoning wave found in American *Uca*. Rather, it shakes obliquely up and down several times, as the crab sits by its burrow or prances toward a neighboring female.

The first time I saw a Shaker dancing was on the carefree island of Bora Bora. It was a red-letter day because none of that species on nearby Tahiti, where I was based, had yet started their display season. In the hope of finding the crabs more active on Bora Bora I flew over that morning on an island-hopping plane. The crabs were performing nicely as I sat motionless beside them when a sudden shadow sent them all down their burrows. The shadow proved to belong to my taximan who had brought me to this sheltered

A Tahitian fisherman casts his net while the tide is high. Fish are swimming over Fiddler Crabs (*Uca tetragena*), now safe in their burrows. Miss Crane worked here at the low tide.

Photo: Studio Mackenzie, Tahiti.



cove in a truck and was now prepared to settle down sociably and watch the performance too. He wore a wreath of white tiare blossoms and on that coral beach beneath the coco palms he looked exactly right. It was cheerful to picture him, complete with posies and a Polynesian smile, driving a cab in Manhattan; he certainly would have lightened up a dingy morning.

The next time I saw a Shaker was on a little island part way up the Red Sea. It was July and the cool breezes that are routine in the South Pacific were unimaginable. A mile or so away the domes and minarets of Massawa shimmered and bobbed in a golden mist, like a desert mirage moved east from the Sahara. It was so hot that every decision to move the camera gear and myself another fifty yards required a mental push. When I reloaded motion picture film, in the thin shade of a scrawny mangrove, the emulsion felt almost like the sticky side of scotch tape. By that time the thermometer registered 112 degrees in the shade and in the sun the mercury flowed on up to the top, stopping reluctantly against the glass. Farther down the beach my waiting boatman dragged himself out of the water where he had been sitting, because that particular patch of Red Sea had now become hotter than the air. Yet here was the Shaker, dancing energetically with the inimitable rhythm he had shown in the South Pacific, apparently perfectly adapted to this hades he called home.

I saw the Shaker once more, this time under far more comfortable conditions. It was in Zanzibar, at a time of the year when the climate was as pleasing as that of any South Sea isle, with breezes, some photogenic clouds, an amiable sun. The scenery was similar too; coco palms leaned over the blue-green bay and surf flashed on a reef beyond. The human scenery, however, had changed a lot between Bora Bora and Zanzibar. Here instead of palm-leaf huts the sultan's country palace rose above me, sugar-white with crenellations round the roof. As I watched, the scarlet car of the ruler himself rolled through the palms and into the palace gate. Two girls came along

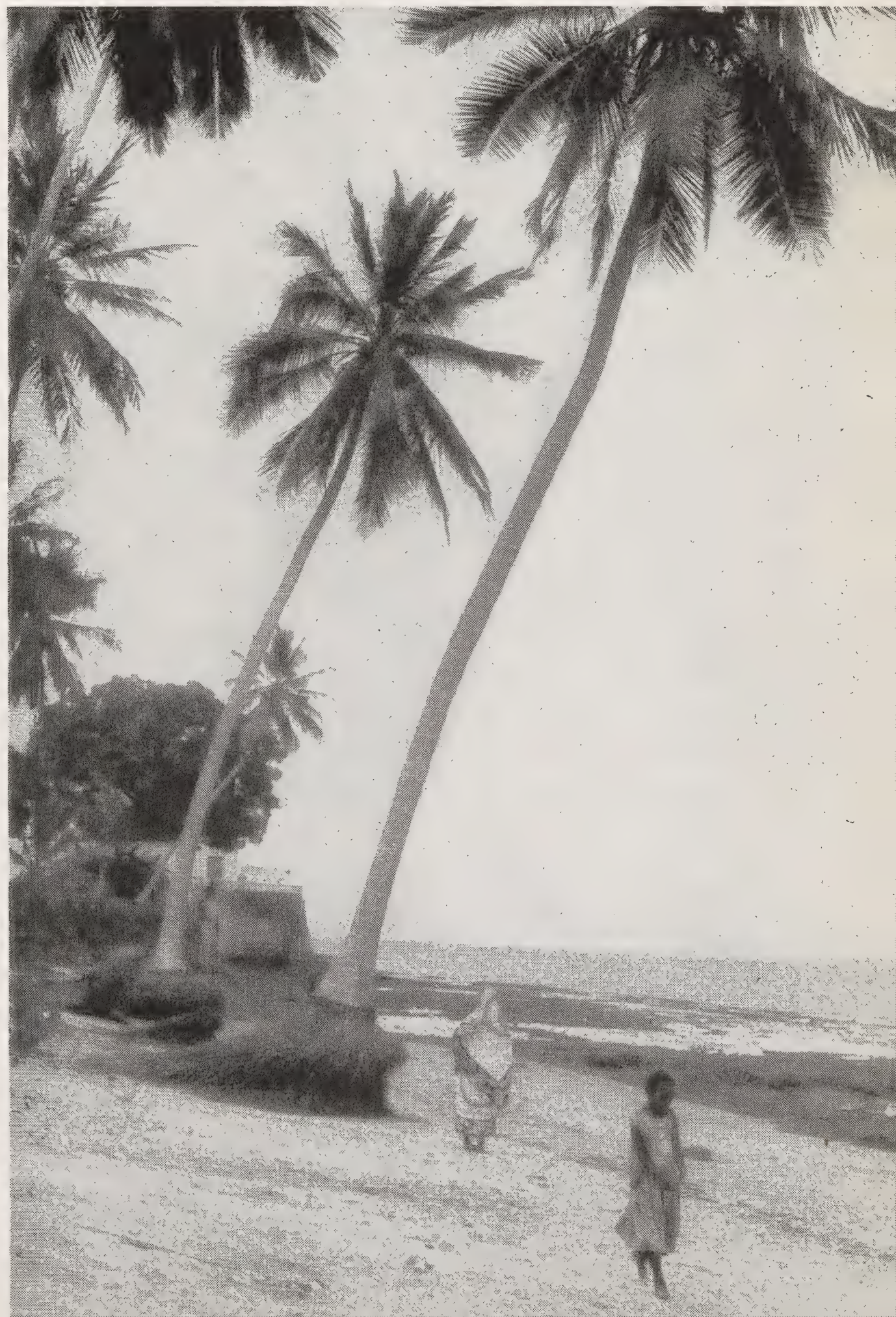
Along this shore in Zanzibar there was plenty of opportunity to collect and study the Fiddler Crab known as *Uca tetragonon*. Part of one of the Sultan's palaces is in the background.

This and subsequent photos by the author.

the shore, looking a bit like Hallowe'en witches in their black-and-orange kangas. When they saw my foreign clothes they pulled their veils across their faces and hurried on. Tahitian girls would have come up beaming and passed the time of day.

At my feet once more were the changeless Shakers, bright with blue and red and shaking their claws as usual. Human clothes, houses, languages differ from place to place, but the Shaker display does not vary. If the taximan from Bora Bora could have suddenly appeared and turned a South Pacific fiddler loose to dance on the African beach, there could have been two predictable results. First, any female fiddler would have responded as though that crab had been born on Zanzibar. But the human Polynesian would have needed an introduction to the local African belles.

It was partly to find out whether the behavior of this and other widespread fiddler species differed in various parts of their ranges that I undertook my own globetrotting. In planning the work it seemed that the crabs' habits might tend





to differ on the far-separated edges of their ranges, even though the structural details of shells, claws and legs remained the same. That is, it seemed likely that evolution might work on activities, on characteristic motions, first, while consequent changes in morphology followed along later. As shown by the shaking *tetragonon* and others, that possibility has not proved to be true. The detailed characteristics of display seem, on the contrary, to be as firmly fixed in the heredity of a species as the diagnostic ridges on the claws. Under appropriate conditions any crab dances only in the manner characteristic of its own species, and the species maintains the same rhythm from one margin of its range to the other.

Although very little is yet known of this aspect of behavior in most animal groups, it is well established that the songs of some birds differ in various parts of their ranges. This variability probably occurs because birds perfect their songs partly through learning, through listening to other birds sing. Accordingly in somewhat isolated areas "dialects" may develop. With crabs and most other invertebrates, however, learning plays little part in the development of behavior patterns; there are no parrots among fiddlers.

The more I have learned of fiddlers, the more

Fiddler flats and mangroves in the foreground at low tide, just outside Zanzibar Town. The house in the background was Livingstone's in 1866 when he was preparing to go into Africa.

surprising it seems that they have spread so widely. It is surprising because, unlike ocean-going whales and fishes, adult crabs cannot swim through the seas. It does not seem at all likely that they hitch hike on logs or ships or drifting coconuts; even if by rare accident an individual may be caught out of its burrow by the tide and carried on some transport out to sea, its legs are not adapted to clinging and climbing.

In fact, except perhaps for a handful of such improbable hitch-hikers, the only way the fiddlers have ever been able to cover long distances is in their sea-going larval stage, as spiny little zoeas. Female fiddlers of all species release their hatching eggs into the water near their burrows. From that moment the zoeas are carried helpless by the currents, often far out to sea. Before it molts into a shore-living adult every youngster must reach some suitable patch of sand or mud — or perish.

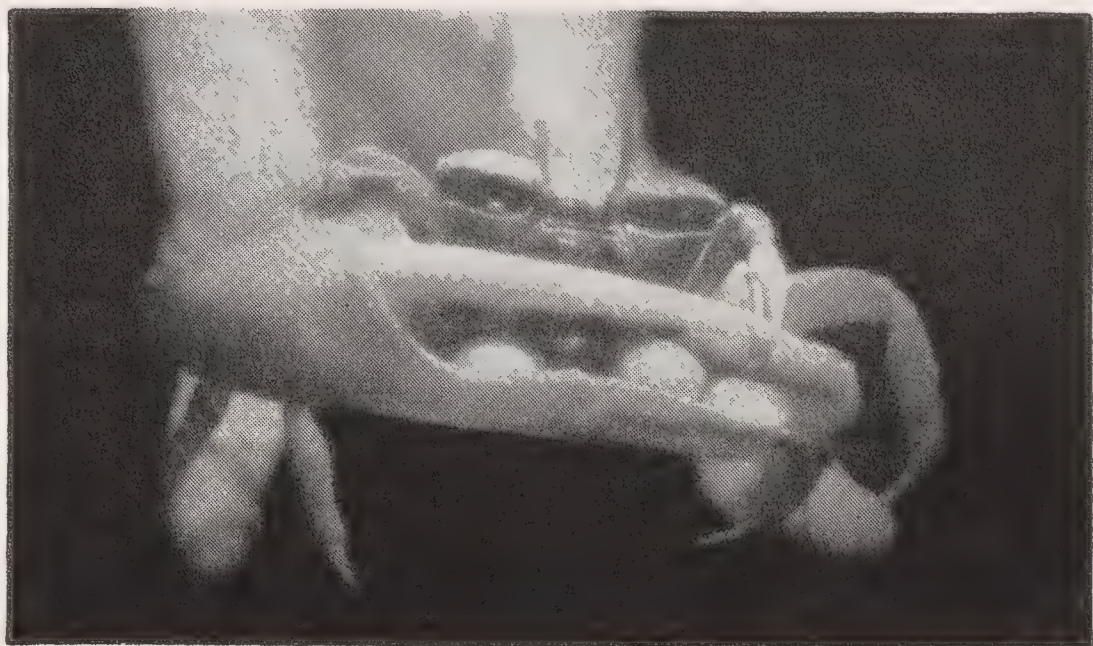
Such rare successful voyagers were drifting from one tropical shore to the next long before the Polynesians made their first canoe or the first

dhow from Arabia sailed the eastern seas. It is easy to understand how, in time, fiddlers could thus spread from their family home in the Malayan region along the edges of the Indian Ocean to East Africa; the wide stretches of the Pacific must have been a greater challenge.

The realization of that challenge came to me first on the day I left the Shakers on Bora Bora for the return trip to Tahiti. We were in an old-fashioned little seaplane with slits for windows. Passengers faced each other at close-range laden with babies and bouquets, and the radio operator climbed to his place amidships via the seat-backs, after which his knees hung intermittently in the aisle. All went well until we reached Raiataea, the last stop before Tahiti. Trouble then developed with an aileron and, since it was already late in the afternoon, we could not leave before morning at the earliest; nobody willingly flies the South Pacific in small planes after dark. This change in plan was of course unremarkable;

planes are constantly delayed all over the world, patched up and sent safely on their way.

The small incident however gave me an unforgettable lesson in time and space. In less than three days I was to leave Tahiti on the semi-monthly plane to Fiji; because of a close schedule it was important to catch that flight. Yet there was no way to reach Tahiti on time save by our crippled plane, the wind being unfavorable to sailboats and no sea-going launch being in harbor. Tahiti, which earlier had seemed a pleasant two-



Left — Miss Crane ready to begin collecting at Luanda, Angola. Some burrows were 3 feet deep. Above — A giant among fiddlers: *Uca tangeri*, dug on the beach pictured opposite.



hour jaunt away, now resumed its primordial distance. So as I stood on that alien shore in the lonely dusk the accomplishments of early Polynesian sailors for once became real.

At the same time the unconscious feats of the fiddler larvae seemed equally impressive. Fiddlers have, somehow, made trips to almost everywhere — from Malaya to Somaliland, and to South Africa, Australia, Japan, Ecuador, New England and Brazil. Sometime, too, in the past they crossed the Atlantic and one species now waves from Portugal all the way down to mid-Angola. Often the principal ocean currents are against the route of travel and sometimes, as around the bulge of Brazil, there are no hospitable shores for hundreds of miles. Yet the fiddlers of the past made the journeys and some of them must make fantastic voyages today.

Next morning, as we flew safely over the wide sea, it seemed clear that fiddlers are the heroes of one of the biggest stories of success in all the animal world.

Zoo News In Pictures

By Sam Dunton

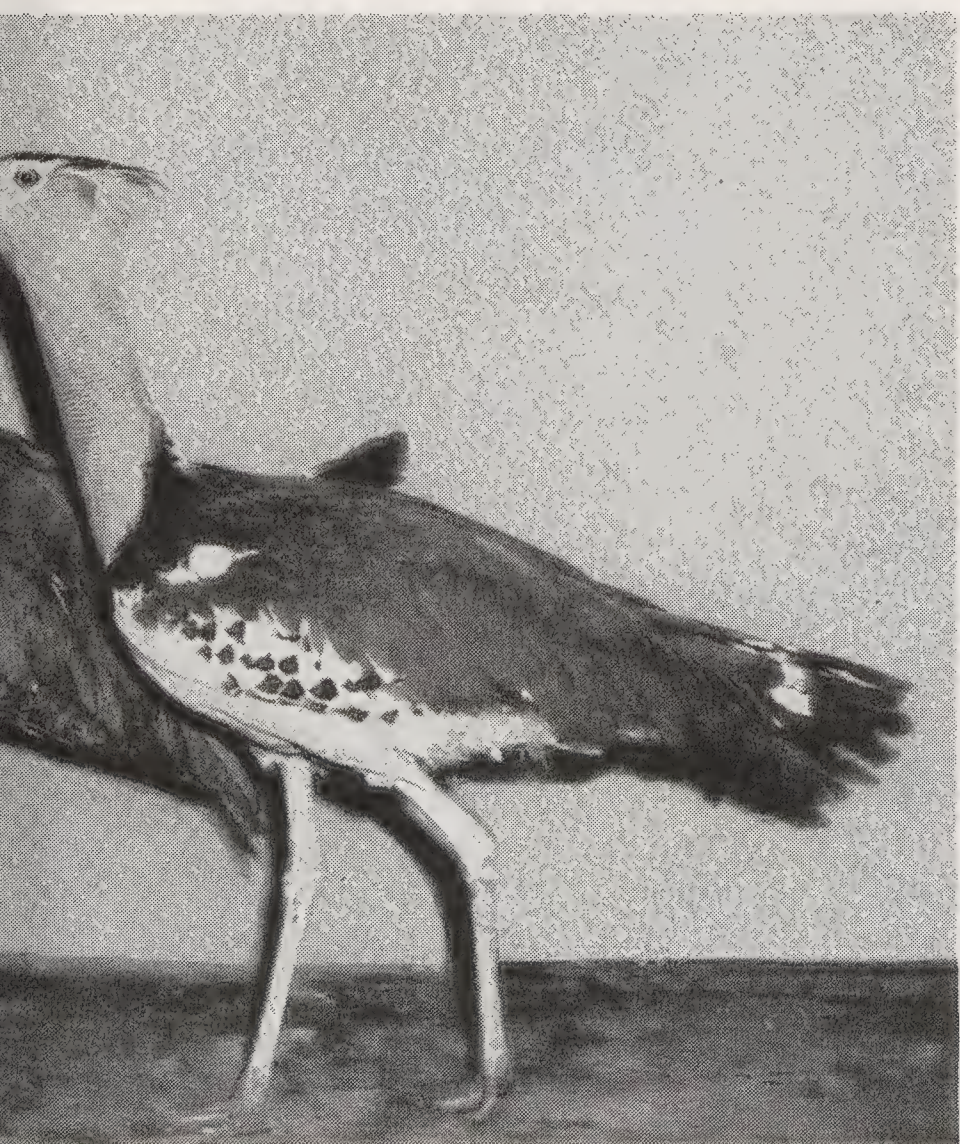


The title of "Most Courteous Bird" must surely be awarded to the male **KORI BUSTARD**, standing slightly in advance of his mate in this picture. For the past four months he has been assiduously attentive to his mate — so much so that she rarely gets to take a bite of food for herself; the male picks it up and passes it from his beak to hers. We now have hopes that these rare East African birds will breed next spring. A yard with tall grass is planned for them.

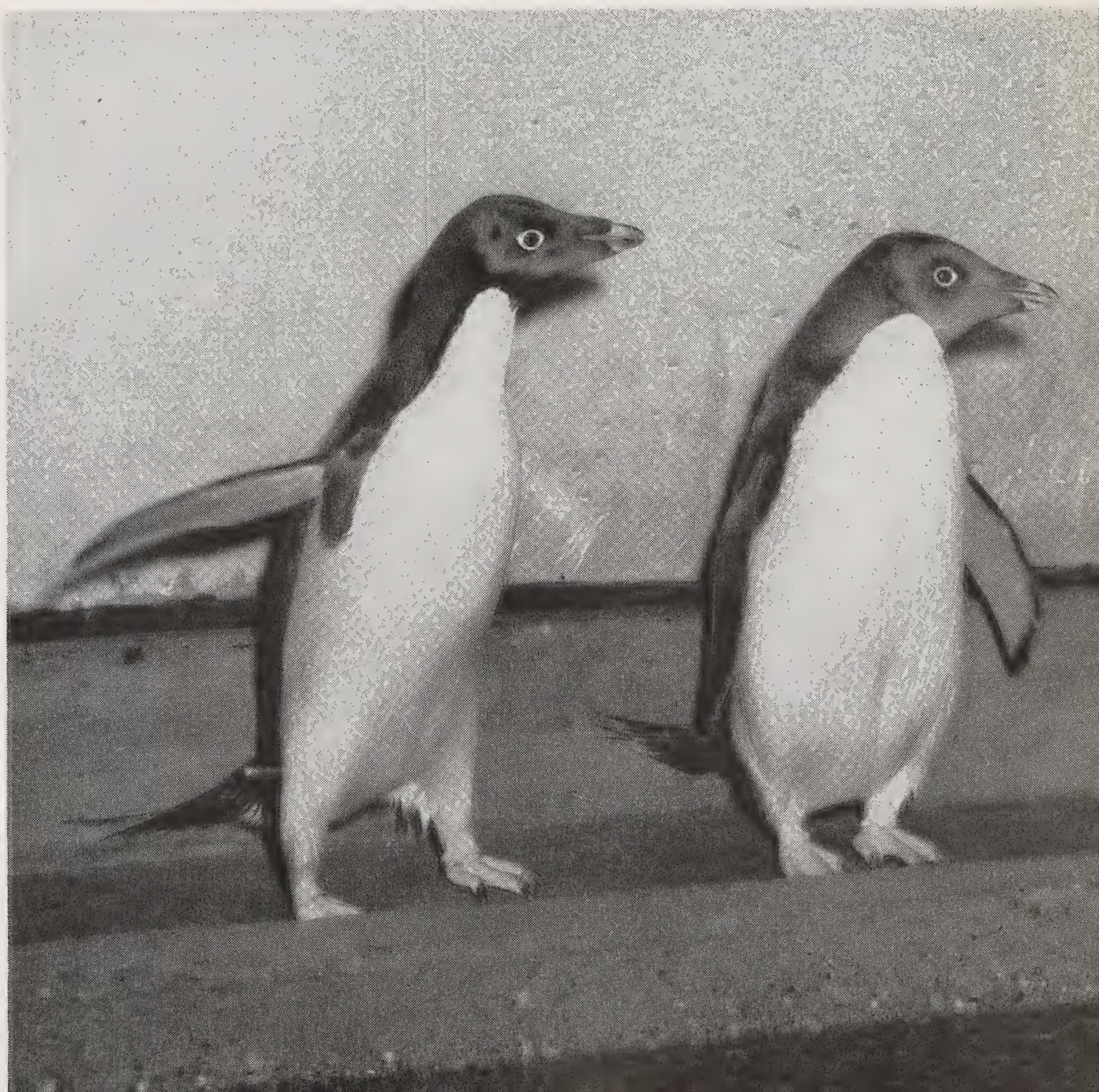
When this little **BLUE DUIKER** was admitted to the Animal Hospital last fall for treatment of her hoof, she was jumpy and inclined to be afraid of the Hospital attendants. Inevitably she was nicknamed "Baby," and petted, and now she is perfectly at home all over the Hospital. While her compartment is being cleaned she has the run of the place. Occasional visitors to the Hospital, not knowing she is a pet, hurry to the office to report there's an animal loose.



For the first time in many years our varied collection includes an **OLM**, or **EUROPEAN BLIND SALAMANDER**. Without pigment, with vestigial eyes, short limbs and external gills which it retains throughout life, it shows extreme adaptation for life in underground streams. Our specimen is a gift from Charles E. Mohr, who had maintained it for a year. It feeds on small crustaceans and worms, and ours is feeding readily on earthworms.



Members of the Zoological Society will recall an excellent motion picture, "Adelie Penguins of the Antarctic," which we showed at the mid-winter Members' Meeting last year. Now we have two **ADELIES**, our first in the collection, and they came to us through the man who made the picture, Dr. William J. L. Sladen. Collected deep in the Antarctic (Adelies are among the southernmost-breeding penguins) by "Operation Deep Freeze," several of the birds were flown north to Portland, Ore., and were distributed among various zoos. Aspergillosis, almost invariably fatal to penguins, struck the group. We have lost two of the four birds presented to us, but the remaining two are being treated with new and experimental fungicides and there seems to be a slight chance of saving them. At any rate, they are feeding for themselves, and recently are gaining slightly in weight.



REMEMBER THEM?



DACCA, RAJPUR and **RANIGANJ** were 7 weeks old when Staff Photographer Dunton took this delightful picture in 1944. We reproduced it on the cover of *Animal Kingdom* and in an accompanying article General Curator Emeritus Crandall tried to describe and forecast the temperaments of the youngsters. Little Dacca, he said, was obviously “a hoyden, always sweet.” Rajpur he described as “slow, fat, lazy and good-natured.” Raniganj was the only black sheep; he was “furtive and unpleasant.” Well, what have the years done to our little Tigers? Are they still sweet, and lazy, and furtive? Opposite are their portraits as they appear today at the age of 14 years. Dacca is still sweet, and Rajpur is still lazy. Raniganj? Well . . . self-sufficient!

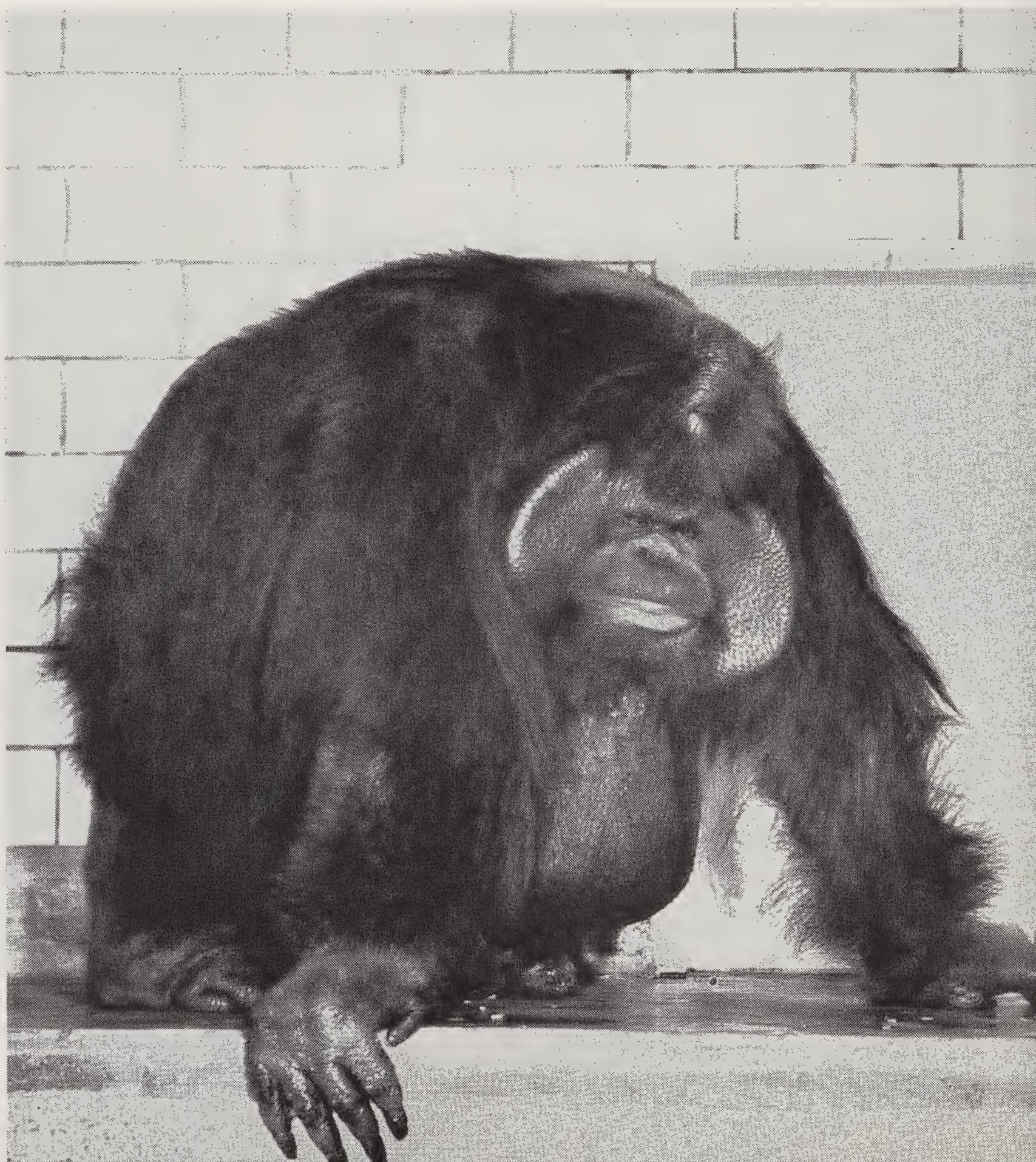


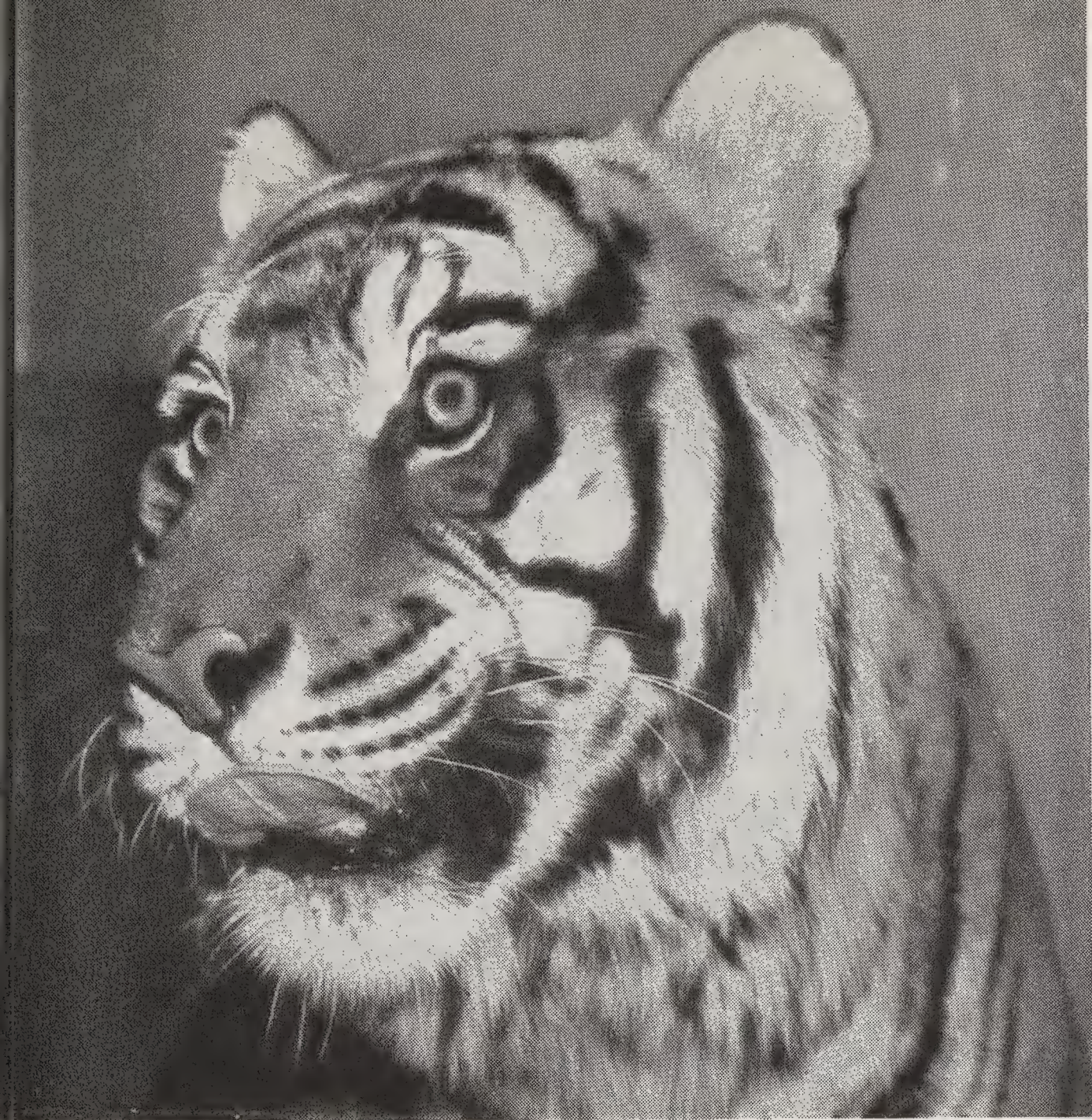
DACCA

ANDY — REMEMBER WHEN?

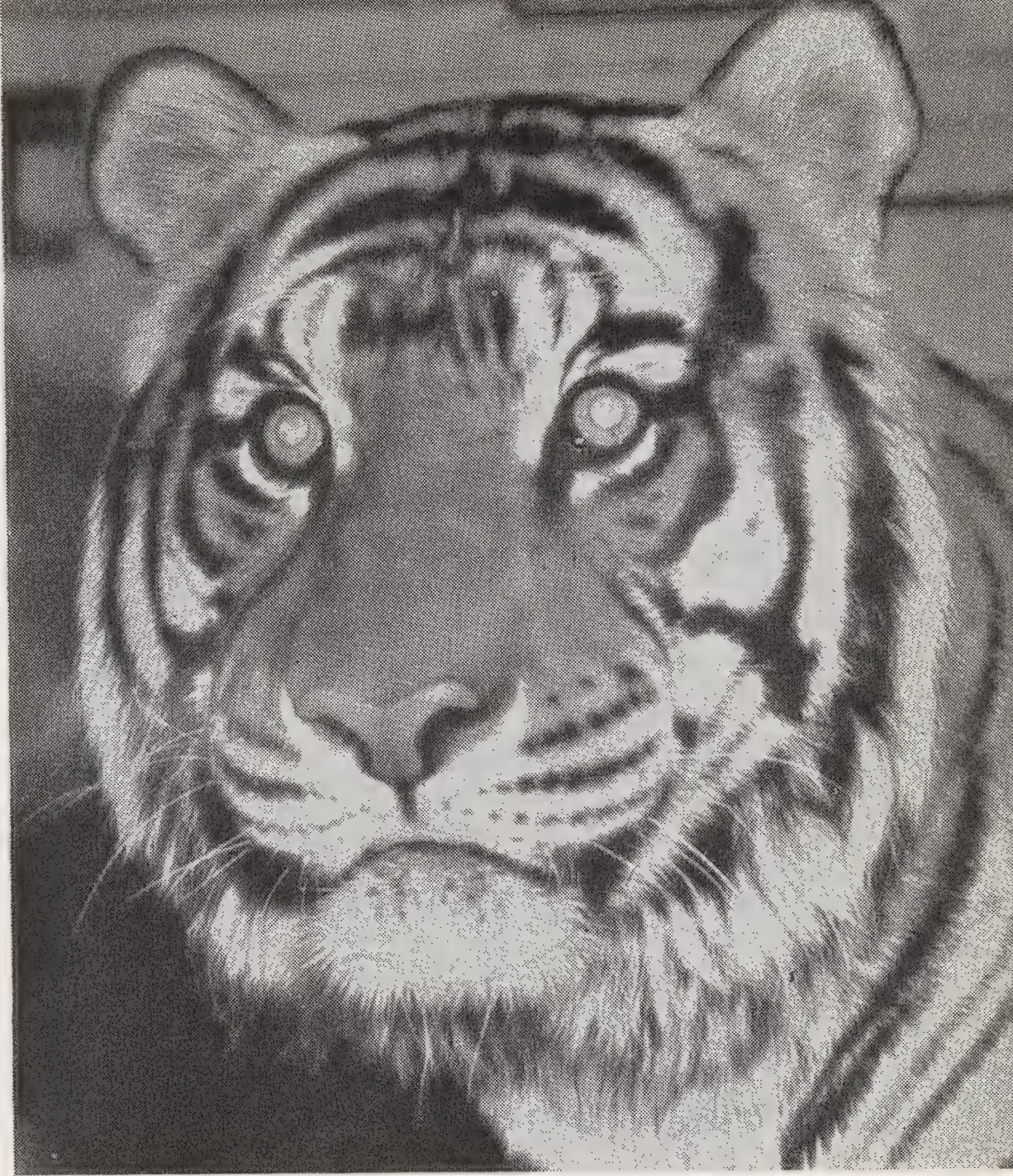


When **ANDY**, the **ORANG-UTAN**, came to us in the summer of 1947, he was a shy and affectionate baby, always solemn and never so happy as when he was clinging to one of his human companions in the Animal Hospital, where he was quartered for the first few weeks. At the right is Andy as he is today — 400 pounds in weight, with a great throat pouch and enormous cheek pads. He is too fat; that we admit. But his obvious interest in people has never abated; he is still gentle and friendly.



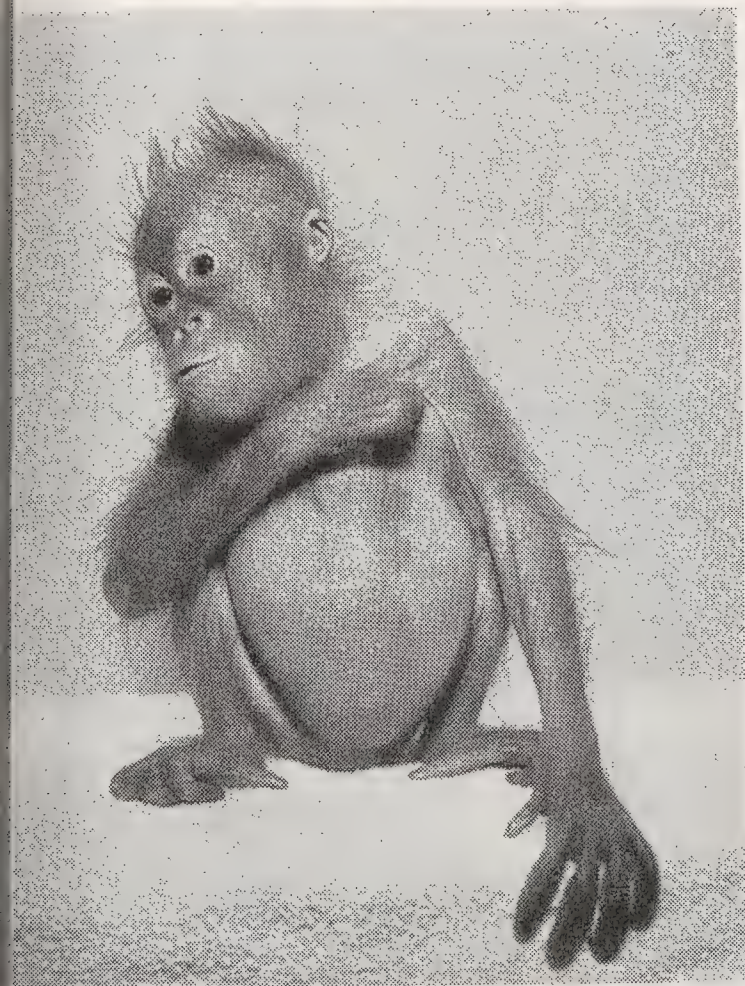


RAJPUR



RANIGANJ

THIS WAS SANDRA



Andy's inseparable companion since the fall of 1948 has been **SANDRA**. Life with Andy has *not* been a bed of roses. No matter how praiseworthy his relations with human beings, Andy has been — well, pure Orang-utan — when it came to Sandra. When she climbed, he grabbed her by the hair and pulled her down. Eventually she was almost hairless. He still grabbed an arm or a leg. He ate his food — and Sandra's too. Lately we have separated them often and Sandra is getting plumper now.



Africa's Champion Digger

By WILLIAM BRIDGES

THE AARD-VARK is an animal that looks a little like a pig — and acts a great deal like one. That sleeps all day — and snuffles, shuffles, digs, and in general behaves interestingly, only at night. That eats raw termites by choice — but will accept chopped raw meat, raw egg, cereal and milk by necessity. It is a grotesque anomaly in the general run of Zoo animals, and we are happy to have one on exhibition again after a lapse of more than half a dozen years.

Pig-like it may be in appearance (although our own Guidebook speaks of it not unaptly as “looking somewhat like a huge, ungainly, slow-moving rabbit”) but it is not a pig; it has a whole zoological Order to itself, the Tubulidentata. *Orycteropus afer* is its scientific name and there are a dozen or more races, all confined to Africa south of the Sahara. Ours is *Orycteropus afer ruvanensis*.

It is too bad that we do not know, and have no way of finding out, how our new young Aard-vark was captured. Any capture of an Earth-pig is likely to be an exciting business, for it is a champion digger and even in hard-packed earth is said to be able to dig just about as fast as a team of native hunters can shovel after it.

Our Aard-vark weighed 107 pounds when it came to us on December 11, making us think that it must have been captured when still a baby, for it was in captivity in Africa for at least 14 months before it came here. All we know is that it was captured near Rumuruti in Kenya sometime late in 1956. Since a full-grown Aard-vark is said to weigh about 140 pounds (we have had one that weighed exactly 140 pounds on arrival, and another that weighed 154 pounds), a 107-pounder is obviously still growing, and 14 months ago must have been pretty small.

There is this to be said for it: young or not, it is perfectly coordinated as far as defence is concerned. A couple of weeks ago Hospital Attend-

ant Gus Waltz had occasion to enter the Aard-vark's compartment in the Animal Hospital, where it is temporarily quartered until room is made for it in the Kangaroo House. The animal was sound asleep in typical Aard-vark posture, curled in a tight circle with its snout protected by hind legs and tail. As Waltz worked quietly, the animal awoke, uncoiled, stood on all four feet, and then suddenly let fly with its hind legs. A stinging shower of tanbark bedding covered Waltz from head to foot and for a moment blinded him. The Aard-vark made no attempt to follow up and attack with its foreclaws.

This is our seventh Aard-vark since 1924 and none of them have done particularly well — two years, two months and two days is our best record. With a few exceptions, other zoological gardens have had the same experience. London, however, is on record as having kept one for ten years and another for six, which makes us think that if we give this healthy youngster exactly the diet and exactly the living conditions it wants, we can do a good deal better than ever before.

As for the diet, the standard mixture for such specialized feeders has always been chopped meat, raw egg and milk. Some zoos have had good results by mixing cereal into this soupy substitute for ants, and we are now adding dog-biscuit meal, codliver oil and bone meal. The Aard-vark seems to like it; at any rate, it whips its long, sticky tongue into five quarts of the stuff every afternoon and licks the pan clean.

Years ago someone on the staff tried to think like an Aard-vark and imagine a captivity-diet that it would like better than meat-egg-milk. At some trouble we imported a 100-pound bag of dried locusts from Africa, a bag of dried flies (water boatmen) from Mexico and, as a sure-fire delicacy, a generous quantity of ant pupas from Europe. Moisten any of these and they imme-

diately become tender, juicy and (to an Aard-vark) irresistible. Or so we thought.

The Aard-vark merely sniffed them. It did not even do us the courtesy of flicking out its tongue for a taste.

As far as living quarters are concerned, the emphasis is again on thinking like an Aard-vark. In Africa, the animal spends the daylight hours deep in its burrow and comes out only at night to wander and feed. We cannot — or, rather, do not want to — give it a real, concealing burrow; a zoo, after all, is for exhibition. We do concede that the Aard-vark would be happier with a deep bed of earth or tanbark, something in which it can partly but not entirely conceal itself. And so a special sleeping box is being built in the Kangaroo House — a low box, partly roofed over to give a feeling of snugness and intimacy, with a glassed front so the sleeping Earth-pig will be at least visible to visitors who will take the trouble to stoop.

The best account of an Aard-vark's way of life in the wild that I know is R. Verheyen's in his ethological study of mammals in the Upemba National Park in the Belgian Congo.¹ What follows is a paraphrase of the Verheyen article.

¹ Verheyen, R. Contribution à l'Etude Ethologique des Mammifères du Parc National de l'Upemba. Institut des Parcs Nationaux du Congo Belge, Brussels, 1951.

The Aard-vark digs with astonishing ease, using its powerful claws and its heavily muscled tail, the latter helping to thrust out the earth dug by the feet. A new burrow is smooth-sided "as if a big python had forced a passage through a hole too narrow for it." The horizontal burrow is some seven to ten feet long and ends in a chamber where the animal sleeps; it is big enough for the Aard-vark to turn around in, for it customarily enters and leaves the burrow head-first.

Quite a number of other animals make use of abandoned Aard-vark burrows — Warthogs, Porcupines, pythons, small rodents, mongooses and occasionally Servals, Leopards, Jackals and wild dogs.

Ordinarily the Earth-pig is strictly nocturnal and does not emerge until complete darkness, but occasionally in the dry season or in high areas where the nights are quite cool it does a little sunbathing at the entrance to its burrow in the early morning sunshine.

"The exit of the Aard-vark from its burrow is as spectacular as it is strange," Verheyen wrote.

Our first Aard-vark in half a dozen years. It is still a growing youngster and appears to be quite healthy and adjusted to life in the Zoo. It is now on exhibition in the Kangaroo House.



"After standing immobile for several minutes at the entrance to its burrow, to catch the slightest sounds, it takes off suddenly with great leaps which carry it a dozen metres from its hiding place, after which it stops equally suddenly to look around the neighborhood, standing on all four feet, the ears erect and the head turning in all directions. Soon it starts moving again and in several long jumps makes a kind of semi-circular trip around its lair to size up the situation, listening and looking. When it is satisfied that everything is all right, it trots away."

Feeding then begins, on all sorts of termites and ants except the big red ant; termites are its primary food. Breaking open termite mounds produces comparatively poor results and "the only rational method of hunting" is to seek out whole colonies of termites at night, when they are on the march. These bands may be composed of tens of thousands of individuals, in columns ten to forty metres long. The Aard-vark is guided to them by its keen hearing (picking up the sound of thousands of tiny termite-feet in the leaves of the forest floor) and also by its sense of smell. In the course of a night it may wander ten to thirty kilometres (about six to eighteen miles).

It is the general belief that the Aard-vark feeds exclusively on ants and termites, but Verheyen reports some curious circumstances that indicate a vegetable diet too. According to natives working for him, the Aard-vark carefully buries its droppings in a hole which it digs in loose earth.

"Intrigued by this odd behavior which, in a wandering animal of this kind seemed inexplicable, we questioned the workmen at length and learned — not without trouble, for they did not understand the drift of our questioning — that it was a matter of the Aard-vark 'fertilizing his fields,' the latter being the place where, according to our taxidermist, it would 'grow its peanuts.' Subsequent investigation revealed that it was a question rather of a gourd-like plant . . . which develops aerial roots that lengthen from day to day, finally penetrating the soil, where the tips swell and become white balls 5 or 6 centimetres in diameter, with a soft skin, and containing a gelatinous liquid and numerous flat, soft seeds.

"Considering that this plant does not grow in clumps . . . and that it thrives only in loose soil, we give some credit to the assertions of our work-

man who claims, first, that the fruits are gathered only by the Aard-varks, which are very fond of them and, after digging them up, break the skin by pressing with the muzzle and then lap up the contents by means of the tongue, and furthermore that the plant is found only in the little pits dug by Aard-varks — in which, after germination of the plant, insect remains can easily be found.

"The same native, whom I had directed to . . . analyze the contents of the digestive tract of an Aard-vark, showed me seeds found in the intestine which strangely resembled those we found in the fruits of the gourd-like plant.

"At present, however, we do not attach real importance to this finding, which we attribute simply to chance and to products accidentally swallowed while feeding."

[Although Verheyen reports the native statements at some length, only to disclaim any positive belief in the "proof" offered by the intestinal contents, it is of interest that in recent years zoological gardens have found that Aard-varks do much better if they are given a certain amount of carbohydrates in their diet, in addition to the protein diet of meat-egg-milk.]

Usually one, but occasionally two, young are born at the beginning of the second rainy season, in October-November. The young Aard-vark remains in the burrow for about two weeks and then begins to accompany its mother on her nocturnal rambles. In subsequent weeks the mother digs a series of new burrows, occupies them briefly, and moves on; by the time the youngster is some six months old, it has begun to do its own digging.

Lions and Leopards are the principal enemies of the Aard-vark, but even these must attack with caution, for while the Aard-vark will run away, if hard-pressed it lies on its back with all four sharp-clawed feet in the air for protection.

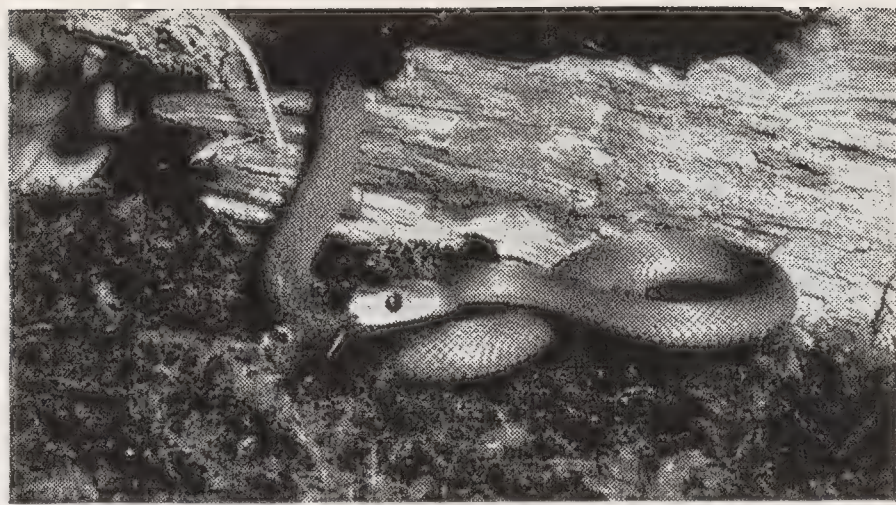
Next summer, if our Aard-vark maintains its present excellent health, we contemplate an interesting experiment: liberating it in an area of hard-packed but concrete-based earth, such as the old Prairie Dog enclosure, and photographing it while digging. If it is only half as good a digger as field observers report, it will need to be a comfortably cool day when we try the experiment and start a shovel crew on the job of digging it out again.

ON EXHIBITION NOW:

The Taipan,

Australia's Deadliest Snake

By JAMES A. OLIVER



THE THREE MOST DANGEROUS SNAKES in the world (probably) are the King Cobra of southeastern Asia, the Black Mamba of Africa and the Taipan of Australia and New Guinea. On the morning of December 7 we pulled the nails out of a stout shipping box, lifted out a closely-woven cloth bag, gingerly snipped the twine that bound its neck, and stood back while 12 baby Taipans slid out into a waiting snake-proof container.

We have long had King Cobras and Black Mambas; the novelty has long since worn off. But as far as we know these are the first Taipans ever seen alive outside their native land.

* * *

Australia is the only continent that has more venomous than non-venomous snakes. In fact, more than seventy kinds of venomous snakes are known from Australia, and it is fortunate for the human inhabitants that few of them are large enough or sufficiently abundant to represent a serious menace.

Five species are primarily responsible for the small number of snake bites recorded each year. These are the Tiger Snake (*Notechis scutatus*), the Copperhead (*Denisonia superba*) — no relation to the American Copperhead — the Death Adder (*Acanthophis antarcticus*), the Common Brown Snake (*Demansia textilis*) and the Red-bellied Black Snake (*Pseudechis porphyriacus*). The Tiger Snake, indeed, is one of the noteworthy reptiles of the world, possessing one of the most toxic venoms ever tested, but despite this fact it is not responsible for many cases of snake bite. Most Australian snakes, like those

in many other parts of the world, are commonest in areas of sparse human habitation and so cause little real trouble.

In a listing of Australia's most important venomous snakes — important in relation to human beings — it may seem a glaring omission not to mention *Oxyuranus scutellatus*, the Taipan. For not only is it the largest venomous snake on that continent, but naturalist David Fleay and scientist Dr. F. G. Morgan of Australia both rate it as Australia's deadliest. Why does it not head the list? Only because it has a limited distribution and is so rare that it is seldom encountered by human beings.

The Taipan was first made known to science in 1867 when one was killed near Cooktown in Queensland. No other individuals were collected for the next 56 years, when two were taken on Cape York Peninsula in 1923. On this latter occasion it was given the vernacular name of Giant Brown Snake, an allusion to its superficial resemblance to the Common Brown Snake (*Demansia textilis*) and the Mulga or King Brown Snake (*Pseudechis australis*), and described as a new species. This rediscovery stimulated a search for additional specimens to determine its true nature. Dr. Donald F. Thomson of the Walter and Eliza Hall Institute of Research travelled thousands of miles over the Cape York Peninsula hunting for specimens. Everywhere the aborigines spoke of the Taipan with great awe and respect, distinguishing it from similar snakes and representing it as the most deadly of all. After many days of fruitless search, Dr. Thomson heard that a dog had been killed by a Taipan in a

village nearby. He was fortunate enough to capture the snake, the first Taipan to be collected alive. Thomson extracted venom from it several times. It laid 7 eggs and died shortly thereafter. Subsequently Thomson caught five other Taipans and in 1933, on the basis of these specimens, he was able to confirm the identity of the species and establish that it was indeed the same as the snake first described in 1867, a form distinct from all others previously known. In order to avoid confusing it with the Brown Snakes, the native name of Taipan was adopted as its vernacular name. Thomson asserted that some individuals may exceed 11 feet in length, which would rank it as one of the largest venomous snakes in the world, exceeded only by the King Cobra (18 feet, 4 inches), the Black Mamba (14 feet) and the Bushmaster (more than 12 feet).

Possibly influenced by the reports of natives, Dr. Thomson stated that the Taipan is extremely aggressive and continues to fight savagely after capture, often severely injuring itself in its attempt to escape or bite. He added that when it is about to attack, it flattens and raises its head, drawing the anterior body back into a closely folded S. From this position it strikes quickly and accurately, taking a firm grip and biting several times in quick succession.

Largely as a result of Thomson's work, the name Taipan began to appear in scattered publications, but much remained to be learned about it and it was still readily confused with the Brown Snakes. Some studies had been made on its venom but more specimens were needed for further analysis before a serum could be made against its bite.

On July 28, 1950, a young snake collector, Kevin C. Budden, from Sydney, was collecting in the scrub area near Cairns, Queensland. He saw a Taipan emerging from a heap of vegetable debris and quickly pinned it down, grabbing it behind the head. He was some distance from the car in which he had left his supply of collecting bags. Carrying his prize in his hands he returned to the car and was in the process of putting the snake in a bag when it managed to bite him on the thumb. It bit down firmly and was removed with difficulty. Budden's companions were all for killing the snake immediately before rendering first aid, but he restrained them and urged them

to see that the snake was forwarded to the Commonwealth Serum Laboratories in Melbourne in order that its venom could be studied. He knew of the scientific need for information about this rare snake and determined that his catch should contribute to this knowledge. Budden died the next day, but the snake reached the laboratory in Melbourne safely and in *ANIMAL KINGDOM* for March-April, 1953, David Fleay related the thrilling account of his own part in extracting venom from this particular snake.

Since 1950 Eric Worrell and others have learned more of the habits and habitat of the Taipan in Australia and have collected additional specimens. Today the snake is known to occur in Queensland on the Cape York Peninsula, along the Gulf of Carpentaria and as far south as the vicinity of Gympie on the east coast of Queensland. During World War II it was discovered in southeastern New Guinea. In fact, much of our knowledge of it has come from the New Guinea area where Kenneth R. Slater, Assistant Animal Ecologist of the Department of Agriculture's Division of Animal Industry in Port Moresby, has been collecting specimens for study.

Mr. Slater's investigations indicate that in some areas of southeastern New Guinea the Taipan is

Harmless-looking enough — but this is one of the 1 small Taipans that have just come to us, and there is every reason to believe that even though it is baby some 20 inches long, it is highly venomous

encountered fairly frequently. He found it more prevalent along river banks where grasslands interrupt forested areas; boulder-strewn sections of such country appear to be the ideal habitat. The Taipan is active during the daytime and in early evening. His and Worrell's studies reveal that the Taipan is not the aggressive snake others have said it was. Rather it is shy and retiring, taking to flight when encountered, *but* defending itself vigorously and effectively if molested or disturbed. Recent studies on its venom have been made by Dr. F. G. Morgan and his associates at the Commonwealth Serum Laboratories. They have used venom samples from the Taipan milked by David Fleay, from several individuals sent in by Mr. Worrell and from a number milked in New Guinea by Mr. Slater. These



show that Taipan venom is almost as toxic as that of the Tiger Snake and that it ejects an astounding amount when it bites — reportedly twice as much as any other Australian snake. Also, it has relatively the longest fangs of any venomous snake in the Australian area. Among the few human beings definitely known to have been bitten by Taipans, only two are reported to have survived. One of these is Mr. Slater, who has played such a prominent role in getting Taipan venom for the Commonwealth Serum Laboratory. Fortunately — and partly thanks to his efforts — this laboratory now manufactures a specific antivenin against the venom of the Taipan. Despite prompt and modern treatment, Mr. Slater had a very difficult time before he recovered from his bite.

Mr. Slater soon noticed that Taipans from New Guinea differed in color, in the character of the scales on the back and in some characters of the skull. He described this population as a new race, naming it *Oxyuranus scutellatus canni*. The *canni* is in honor of Mr. George Cann, Curator of Reptiles at Taronga Park Zoo in Sydney. One of the striking features of this new race is the broad reddish-orange area on the posterior two-thirds of the back, which is characteristic of all the New Guinean individuals. The natives of the Port Moresby region well know and respect the grayish-black snake with the orange streak on its back. They call it either “Diriora” or “Gobari.”

For several years we have been trying to get a live Taipan for our collection in the Reptile

House. One Australian reptile dealer told us three years ago that if we were willing to pay ten times the highest price asked for any other Australian venomous snake, he could get us a Taipan. We agreed to this rather exorbitant price because no American zoo, and probably no zoo anywhere outside of Australia, had ever exhibited this snake. No specimen was forthcoming and the dealer put an advertisement in a Sydney newspaper, stating that he urgently needed "a live Taipan for an American Zoo — if anyone's game to collect it!" Still no Taipan.

Last summer we communicated our needs to Mr. Slater in Port Moresby. He has a keen interest in herpetology and was most sympathetic to our request, but the pressing need for Taipan venom to manufacture antivenin far outweighed any other consideration. Mr. Slater had ten live adults at the time our letter reached him, but he could not let us have any of these. However, he had a number of Taipan eggs that were incubating and he offered to send us some of the young if we would like to try to rear them. He insisted that we would have to get enough of the antivenin to take care of a possible accident with the little snakes. The warning in his letter was explicit: "I can assure you that the power of the venom cannot be over-estimated."

We replied immediately that we would be delighted to get the young snakes and that we were ordering the antivenin from Melbourne. On October 23, 1957, Mr. Slater wrote that the eggs had hatched after an incubation period of 91 days and that he would soon be sending us a dozen baby Taipans. This was wonderful news. All preparations had been made for their flight from Sydney to New York, but a hitch developed in getting them from Port Moresby to Sydney. The Australian Quarantine people wanted no live Taipans coming in by air, so Mr. Slater had to arrange for them to go to Sydney by boat.

As with so many shipments of animals from Australia and New Guinea, we received invaluable assistance from Sir Edward Hallstrom and our other friends at Taronga Park Zoo. They took the young snakes from the boat when it arrived in Sydney, checked and watered them and then placed them safely on the plane for New York. We were concerned over the prolonged trip and were apprehensive for the health of the

little snakes during their travels. However, on December 7, 1957, a month and a half after they were hatched, the snakes arrived in New York. They came through in excellent condition and we were thrilled to see our first live Taipans.

The lithe, slender, slate-gray youngsters with the prominent orangish backs and bright orange-brown eyes actively explored their new surroundings. They crawled around flicking their tongues in and out, giving the impression of very alert but not excited snakes. Most of them drank copiously after their trip. Mr. Slater had given us the benefit of his experiences with Taipans, suggesting several possible items for their care. He had measured the babies a few hours after hatching and found them to vary from 12½ to 17 inches in length. At shipping time they were not nearly as nervous as they were immediately after hatching, probably as a result of having been handled carefully on several occasions. He hoped we would be able to get them to feed voluntarily, but gave us the formula he had used successfully for forced-feeding the majority of adults he had kept.

Head Keeper Steve Spencook and I set up two large cages for the snakelings, putting half of the shipment in each. We covered part of the floor with damp moss and placed a potted plant and a large water dish in each cage to provide the high humidity Mr. Slater suggested. Then Steve began trying to get the youngsters to eat. Three ate immediately, to our pleasant surprise and relief, and within two weeks nine were feeding. We are still trying to get the remaining youngsters to eat voluntarily, but we feel fairly confident of raising at least part of the brood.

We measured six of those that are feeding and found that they were between 20 and 22 inches. They have a long way to grow to reach the maximum length for their species, but at least some of them are on their way. Today they are interesting and active, non-belligerent little snakelings, but we are keeping Mr. Slater's warning in mind: "It would be unwise to take chances with them when they grow a little larger for one cannot tell when they are likely to adopt the extremely nervous behaviour so common with the adult snakes."

This is sound advice for Reptile Keepers and Curators dealing with *all* species of venomous snakes. But especially with Taipans.

Now Fishes Come in Plastics Bags

By JAMES W. ATZ

MODERN TECHNOLOGY has helped solve many of the problems of keeping fishes and other aquatic animals in captivity. Probably the most spectacular of these advances has concerned the transportation of living fishes. It is now possible to ship small fishes practically any place in the world at reasonable cost, and millions of them are transported long distances each year.

The Aquarium has naturally been aware of these developments; in fact, we tested some of the new methods and equipment when they first appeared; and our collections have, of course, been enriched by the purchase of species never before available on the market. But our appreciation of the advantages offered by the modern techniques took on new dimensions when we ourselves recently became involved in the transportation of fishes to and from such outlying places as Antigua, the Belgian Congo, the Hawaiian Islands and Israel.

Not long ago, Dr. Vernon Brock enlisted our aid in obtaining some *Tilapia* for experimental introduction into the Hawaiian Islands. Dr. Brock was Director of the Division of Fish and



The first of the highly valued Buffalo Fish to reach Israel alive have their plastic bag carefully filled with oxygen at the Aquarium.

Game for the islands, and he has been trying to enlarge and diversify that archipelago's meager fresh and brackish water fauna with useful fishes. A species of *Tilapia* that Dr. Brock had previously introduced was developing into a good bait fish for the fast-growing tuna fishery, and now Dr. Brock was looking for a fish that would eat the coarse vegetation that chokes some of the reservoirs and irrigation ditches on both the Hawaiian Islands and Guam. Of the better known species of *Tilapia*—and there are a good many about which we know practically nothing—*Tilapia melanopleura* or *Tilapia zilli* seemed to fit the bill most closely. They were reported to be plant-eaters, favoring the type of vegetation that needed to be controlled, and *melanopleura* at least had also proved amenable to captivity, hundreds of thousands of them being cultivated in ponds in the Belgian Congo. The only difficulty was to get living specimens all the way from their native Africa to Hawaii.

While checking into the food habits of Tilapia, Dr. Brock learned that *Tilapia zilli* had been introduced into the island of Antigua in the British West Indies.

Specimens from the London Zoo had been brought to the island and were thriving mightily. Our first step in procuring some Tilapia for Dr. Brock was therefore to get in touch with Antigua's Director of Agriculture, Mr. Malcolm Park, to find out whether a shipment was feasible. From Mr. Park soon came the welcome reply that small specimens *were* available and that arrangements could be made with Pan American to fly the fish to New York.

All this sounds quite routine, but behind it lay the assumption that Mr. Park would be able to use the new method of fish shipping to get the Tilapia to New York. In fact, without this technique, there would scarcely have been any point in getting in touch with Antigua at all.

Because of its speed and widespread ramifications into isolated regions not otherwise accessible, air transport is the natural choice for the transportation of all kinds of animals. To carry fish by boat from the far reaches of the West Indies would have required an experienced fish runner, equipped with tanks, heaters, pumps, fish food and all the other paraphernalia necessary to take care of fish for extended periods. Air transport eliminates all this, but places a terrific premium on weight, and for this reason was for many years much too expensive. For example, a shipment of small Tilapia such as we were considering would have required at least twenty gallons of water, and this in itself weighs 167 pounds — to say nothing of a container strong enough to hold so much fluid.

The new method of fish shipping drastically reduces the amount of water necessary as well as the weight of the shipping container and thus makes air freight or express economically practical. Instead of heavy, clumsy tanks, plastic bags are used to hold the fishes. These are so thin and they are practically transparent, and yet they are strong enough to hold several gallons of water. The bag, partially filled with water and fish, is placed in a light corrugated cardboard box, surrounded by insulating material for temperature control. The mouth of the bag is tightly closed by means of rubber bands. Frequently,

for safety's sake, the bag containing fish and water is put inside another plastic bag that is similarly sealed. The box can now be placed in any position without leaking. This used to be a particular weakness of the old, fixed containers; they would frequently be turned upside down during transit, and the fish would then arrive *sans* water, dead.

Some of the old containers for shipping fishes actually depended on access to atmospheric air in order to aerate the water. The new plastic bags are completely sealed off, but advantage is taken of this fact by filling them with oxygen instead of air. This makes it possible to use much less water during shipment, since the fish have a large reservoir of oxygen to draw upon. We wondered whether the fish people on Antigua had access to bottles of compressed oxygen, and were relieved to learn that they did.

Once all arrangements had been made, it was a simple matter to send to Antigua a couple of shipping boxes with plastic bags, rubber bands and a set of complete instructions. All that remained was to wait for the cablegram announcing the fishes' departure. I will remember how excited I was when Tankman Joseph Armstrong removed the plastic bags from their container, a couple of hours after midnight, in the Customs Office at New York International Airport. Would our precious Tilapia be dead?

They were not. A few of them looked a little groggy, probably from the effects of a chill, so we rushed them back to the Aquarium and in an hour or so they were swimming about in one of our tanks with no sign of having recently completed a 2,000-mile trip.

We kept the thirty-odd *Tilapia zilli* for a few weeks, pampering them with the best of food and care so that they would be in tip-top condition for the next leg of their journey — to the Steinhart Aquarium in San Francisco. Packing them for the air trip was routine for Tankman Armstrong, who made hundreds of similar shipments during several years spent in the tropical fish trade. After a week or two of rest and recuperation at the Steinhart Aquarium, the Tilapia were shipped by air to Honolulu, where they have multiplied successfully and will soon be put into reservoirs and irrigation ditches to test their ability to control the excessive growth of aquatic plants.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

End-of-Year Census Reveals 1,044 Species in Zoo

The December 31, 1957, census of the animal collections, during which the staff makes an actual count of every animal in the Zoological Park, gave a combined total for mammals, birds and reptiles of 1,044 species and subspecies. This is the greatest variety we have had since 1941.

The Mammal Department reported 513 animals of 168 kinds. Birds counted 1,505 specimens of 636 forms. Reptiles turned in a count of 613 specimens and 240 species and subspecies, with all zoological Orders represented.

Varied as the collection now is, it falls well short of the record for 1913 when we exhibited 1,290 species and subspecies, and 4,729 specimens. The collection at the end of the year contained only 2,631 individual animals.

King of Morocco Visits the Zoological Park

His Royal Highness the King of Morocco made a rapid but thorough visit to the Zoological Park on December 12. He was accompanied by Richard C. Patterson, Jr., Commissioner of Commerce and Public Events, and James J. O'Brien, Deputy Commissioner. His principal interest, expressed in advance, was in our Primate collection and particularly in our young Chimpanzees.

A Plethora of Pups

When we acquired a pair of Dingos, or Australian Wild Dogs, from the Taronga Park Zoo in Sydney in the fall of 1954, we had no idea that we were going to have a surplus Dingo problem almost immediately. That is the case, however, for the pair produced nine pups on December 30, 1955; five pups on December 23, 1956; and nine more on December 20 of 1957 — the last young born in the Park in 1957. All the pups are thriving, despite the fact that they are being reared in an out-of-doors shelter during the cold

weather. Their mother apparently prefers the out of doors to warmer quarters inside the Kangaroo House.

Aquarium Tankman Poisoned by a Lion Fish

It has often been asserted that the Lion Fish, or Zebra Fish (*Pterois volitans*), is not dangerous, and the effects of being stung by one of its fantastic fins have been minimized. We have recently had dramatic proof at the Aquarium that the sting is intensely painful, and we believe that without prompt treatment it might be fatal.

In mid-December Tankman Edward Dols was



stung by three spines, which penetrated his right thumb for about an eighth of an inch. By the time he reached a hospital 15 minutes later his hand was swollen to twice its normal size and the almost unbearable pain extended to his neck and chest. Penicillin, epinephrine and toxoid were administered and the pain and swelling were much reduced an hour later, although some pain persisted for almost a week.

The accident occurred while Dols was putting a piece of coral into a tank containing three Lion Fishes, a small bass and a Hawkfish. The nervous Hawkfish frightened the smallest of the Lion Fishes toward Dols's hand before he could withdraw it.

Moloch Lizards of Australia Here for First Time

Two of the most bizarre lizards in the world arrived from Australia in late November and one is now on exhibition in the lobby of the Reptile House. They are Moloch Lizards, or Mountain Devils, *Moloch horridus*, and are the first we have ever had.

The smaller of the two specimens was weak and disinclined to eat when it arrived, and succumbed after a few weeks. The survivor, however, is feeding well. About nine inches long, it is chocolate-brown, cream and yellowish-orange in color and its body is thickly studded with broad, sharp spines that cover even the legs and belly. While it is fierce in appearance, in actions it is one of the gentlest and most lethargic of lizards, standing still for long minutes and moving generally in a slow and creeping fashion. Most of its activity comes during the breeding season, when the males may make short rushes at each other.



Mountain Devils come from the dry and sandy wastes of central, southern and western Australia and are known to feed only on ants. An Australian naturalist counted 675 ants eaten by one lizard in 15 minutes. They never drink water, but obtain moisture from ants and an occasional dew-drop.

We were doubtful whether our specimens would adapt their tastes to the kinds of ants available here, but there was little difficulty about it. Curator Oliver baited glass jars with sugar and meat, placed them in the bottom of one of the cages in the Bird House, and each day collects hundreds of tiny red ants which both Molochs accepted. However, the smaller and weaker of the two died after several days.

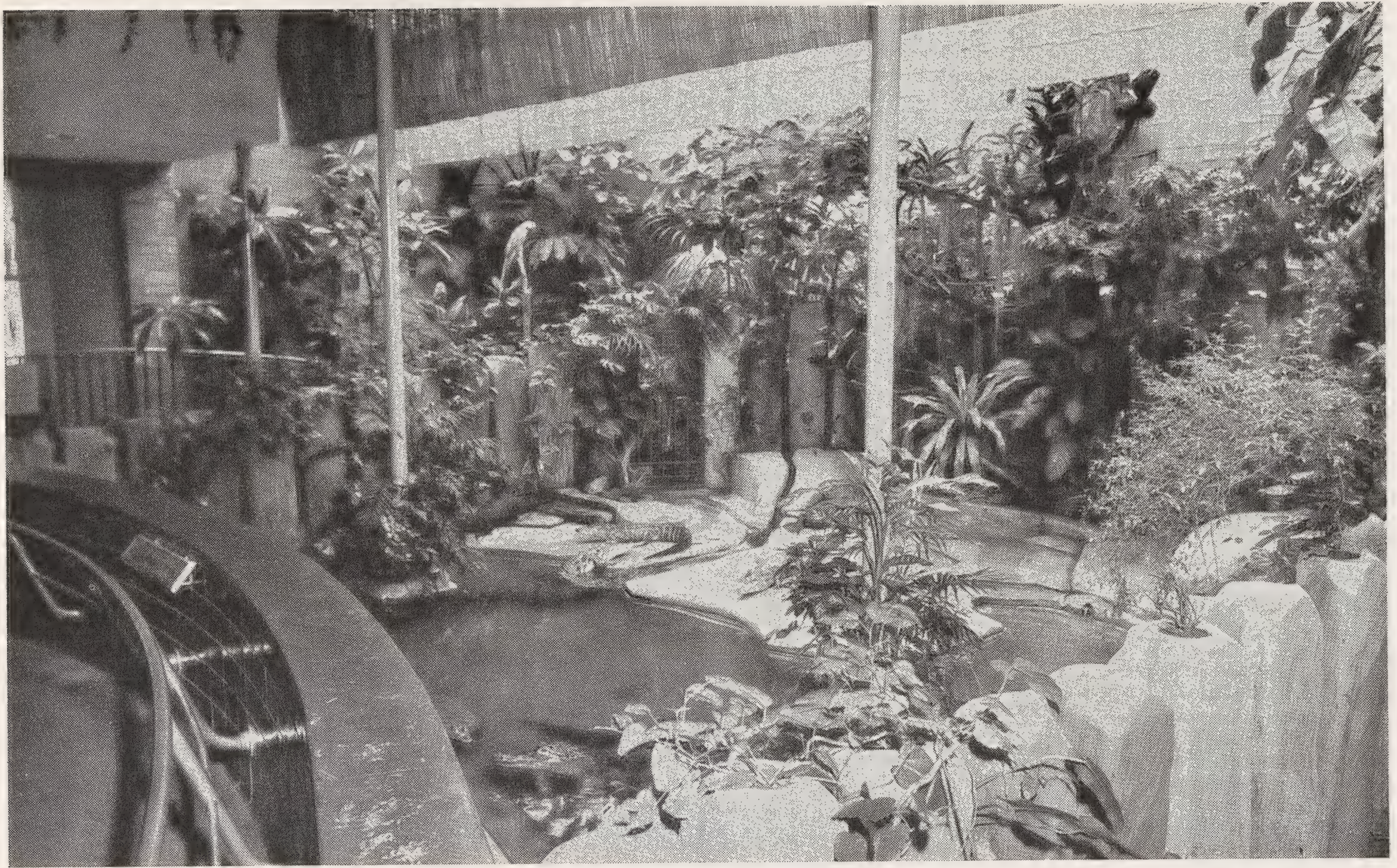
IN BRIEF

Tortoises Wintering in Florida. The coming of cold weather means that our Galapagos Tortoise colony has to be brought indoors from the yard at the east end of the Reptile House and quartered, off exhibition, in the basement of the Heads & Horns Museum. Thinking that the reptiles would benefit by sunshine and warmth, Dr. Oliver took advantage of a Florida trip by the Aquarium's collecting truck just before Christmas and shipped three of the largest tortoises to the Crandon Park Zoo in Miami, where they will have the run of open yards until their return to us in the late spring. We have also sent five Galapagos Iguanas to the Department of Amphibians and Reptiles of the American Museum of Natural History where their temperature requirements will be studied. One of our Marine Iguanas from the Galapagos has been sent to Duke University for study in connection with water and salt regulation in these lizards — study that may lead to the discovery of better ways to keep and maintain them.

Miss Crane Honored. Miss Jocelyn Crane, Assistant Director of the Department of Tropical Research, has been elected a Fellow of the New York Academy of Sciences.

Dublin Got Its Reptiles. As a present to the Royal Zoological Society of Ireland, the Reptile Department recently shipped ten American turtles and two small Alligators to the Dublin Zoo. While they were on the ocean a strike of dock workers broke out in Cork, where the shipment was to land, and for a few days we were concerned as to whether the gift would be sent back to us. However, Irish dockers seem to like animals, and the reptiles were unloaded and delivered despite the strike.

Northeast Wildlife Conference. Dr. Ross F. Nigrelli and Carleton Ray of the Aquarium staff attended the Northeast Wildlife Conference in Montreal early in January and both gave talks before special groups. Dr. Nigrelli addressed the Société de Médecine Vétérinaire of Quebec on "Causes of Diseases and Death of Fishes," and



It might be a scene in the tropics — but actually it is the Alligator Pool in the Zoological Park's Reptile House. The comparatively high heat and humidity allow the tropical plants to thrive and they make a perfect setting for seven species of the crocodilians of the world.

led a discussion among fishery biologists on modern biochemical approaches to aquatic biology. Mr. Ray addressed the Underwater Research and Sport Association, showed an underwater motion picture and led a discussion of skin diving and underwater research. The Aquarium exhibited a variety of local marine fishes and electric eels.

The Questions They Ask! Among recent questions asked (by rather young visitors) at Question House were these:

- Are there any deaf and dumb animals?
- Are bees the ancestors of flies?
- Are Zebras *really* escaped convicts?
- What time do squirrels go to bed?

PUBLICATIONS OF INTEREST

REPTILES ROUND THE WORLD. By Clifford H. Pope. Pp. xvi, + 194, + xii, illustrated with numerous black and white drawings by Helen Damrosch Tee-Van. Alfred A. Knopf, New York, 1957. \$3.50.

Clifford Pope and Helen Tee-Van have combined their talents to produce an excellent simplified natural history of the reptiles of the world. Simplification of such a broad and often complex subject without sacrificing scientific accuracy is quite an accomplishment. I know of no book for the younger reader that has done this so skillfully, so attractively, or so well.

The book covers a wide range of natural history topics, including virtually all aspects of reptilian life histories. For example, there are sections on locomotion, food, reproduction, size, growth, age, where reptiles live, enemies and defense, various habits, relationships, ancient reptiles, dangerous reptiles, finding reptiles, reptiles as pets, their usefulness, their relations to man and their distribution over the world. All of these topics are discussed in a concise and enlightening fashion, and the many illustrations amplify the important highlights. This is a splendid book to give to any youngster interested in natural history and especially to those wanting to know about the fascinating but little-known reptiles. — J. A. O.

A RECORDING OF FROG VOICES

SOUNDS OF NORTH AMERICAN FROGS. Recorded, narrated and documented by Charles M. Bogert. Folkways Records Album No. FX 6166, Folkways Records and Service Corp., New York, 1958. \$5.95.

The calling of frogs is a distinctive and well-known harbinger of spring throughout North America. Yet few people know how much the calls differ from species to species, or even from place to place. And fewer know the biological significance of the frog voices. Charles M. Bogert, Chairman and Curator of the Department of Amphibians and Reptiles of the American Museum of Natural History, has been travelling about recording and studying the varying voices of our native frogs. He has organized and arranged his findings and recordings, putting them on this excellent record and detailing them in an explanatory pamphlet.

The pamphlet is the best printed account of the variations and the biological importance of frog voices

that has appeared. It is illustrated with black and white photographs of the more than fifty frogs considered. The recordings are excellently reproduced and anyone familiar with the calls of some of the species will find it difficult to realize he is not in the haunts of the calling

frogs when he listens to them. The calls and narration are arranged to illustrate essential features of the different calls. The combination of record and pamphlet will provide much enjoyment and enlightenment for any lover of the out-of-doors. — J. A. O.

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Land and Ocean Sanctuaries

ONE OF THE MOST rewarding activities of our Society is that of assisting in the establishment of preserves for the long-term protection of wild animal life in natural environments. Indeed, this work is of the utmost importance because expanding human populations are encroaching more and more upon natural areas which, once destroyed, can never be replaced.

Over the years our Society has been able to accomplish quite a lot in this field of endeavor. For instance, a number of years ago the Society played a part in the creation of the Madison Grant Redwoods and Elk Refuge in northern California. At a later time it provided financial support and sponsorship for the unique Corkscrew Swamp in Florida which, through the work of our sister institution, the National Audubon Society, has now been established as a permanent sanctuary. During the last three years our Society has taken active leadership in a movement which we trust will result in the establishment, through Congressional action, of the Arctic Wildlife Range in northern Alaska.

Until recently no one could have foreseen the need or even the desirability of preserving marine areas. Today, however, it has become abundantly clear that such areas, too, are suffering encroachments by man, and unless adequately protected will ultimately be desolated. The first article in this issue describes a project in "marine" conservation, in which our Society has welcomed the chance to take an active part. We hope the Exuma Cays project may be the forerunner of much more conservation activity of this kind.

Fairfield Osborn

SMITHSONIAN
INSTITUTION APR 18 1958



Something New Under The Sun & Water

THE EXUMA CAYS PARK PROJECT

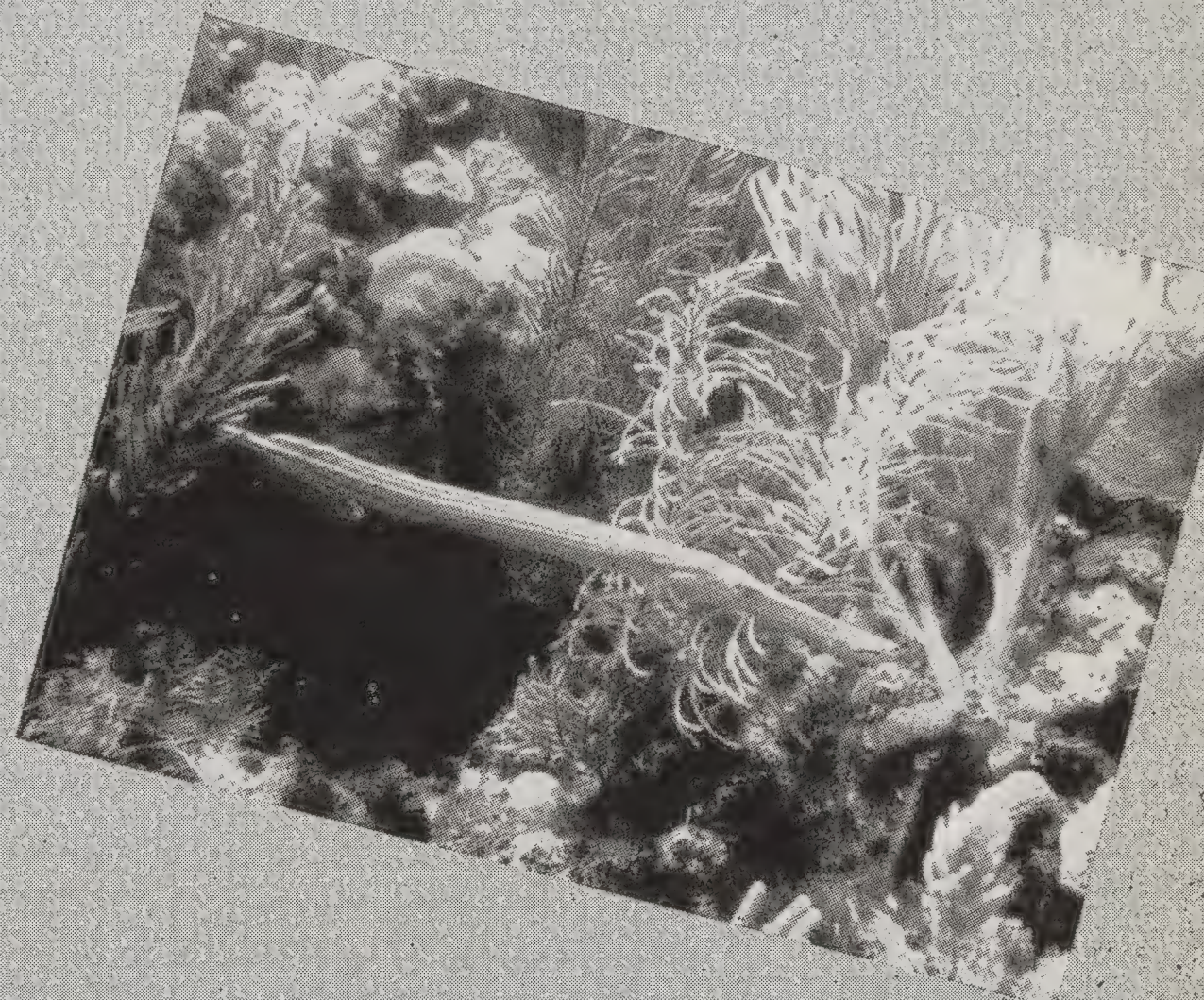
UNDER the prosaic title of "The Exuma Cays Park Project" a new idea is taking shape — quite literally something new under the sun and under the water. In brief, it is a proposal sponsored by the New York Zoological Society in cooperation with the Bahamian Government to set aside a 25-mile chain of cays and their adjacent waters, just southeast of Nassau, as a land-and-sea National Park. It would be the first of its kind anywhere to include land areas and seas to the edge of deep water, with similar conservation policies for both.

It all began in the spring of 1956 when Col. Ilia Tolstoy, a director of the Marine Studios in St. Augustine, Florida, suggested to the government authorities in the Bahamas that they hold up any further leasing to private interests of the cays in the north middle Exumas, pending specific suggestions for the establishment of a national park. Most of the ten major cays — there are many smaller ones — still belonged to the Crown but some were under lease and others were about to be leased. The government obligingly





Left — Shroud Cay is a typical example of the Exumas. Above — Midlands of some cays would be ideal homes for Flamingos. Upper Right — Black Angelfish in an underwater garden. Lower Right — Trumpetfish around a reef. (The two underwater photographs at right taken by Mr. Ray).



By CARLETON RAY

Photographs By RUSS KINNE



agreed to hold off any further leasing until June 30, 1957.

In the fall of 1956 Elgin Ciampi and I were preparing to send to press a book called "The Underwater Guide to Marine Life." Its introduction makes a strong and reasoned plea for underwater conservation and suggests the establishment of actual "underwater parks" to serve as areas of replenishment for depleted species, as sanctuaries for both common and rare species, and as sea gardens to serve esthetic, scientific and educational purposes.

We were so keen on the idea of "underwater parks" (for we had both done a lot of skin-diving and knew from sad experience what is happening among the coral reefs) that we had the introduction to our book mimeographed and sent copies of it to conservationists and marine biologists here and abroad. It was a small effort, but the response was encouraging. We had tentatively suggested the Bahamas as a good place to try out the underwater park idea, and a lot of people went to the trouble of writing to the Bahamian



Above — On the “Courageous,” where the survey party lived, lookouts had to watch constantly for coral reefs in the shallow water. Right — The daily conference of the investigators (L. to R.): Dr. Randall, Oris Russell, Dan Beard, Col. Tolstoy, Dr. Squires, Carleton Ray. They foresee a unique park.

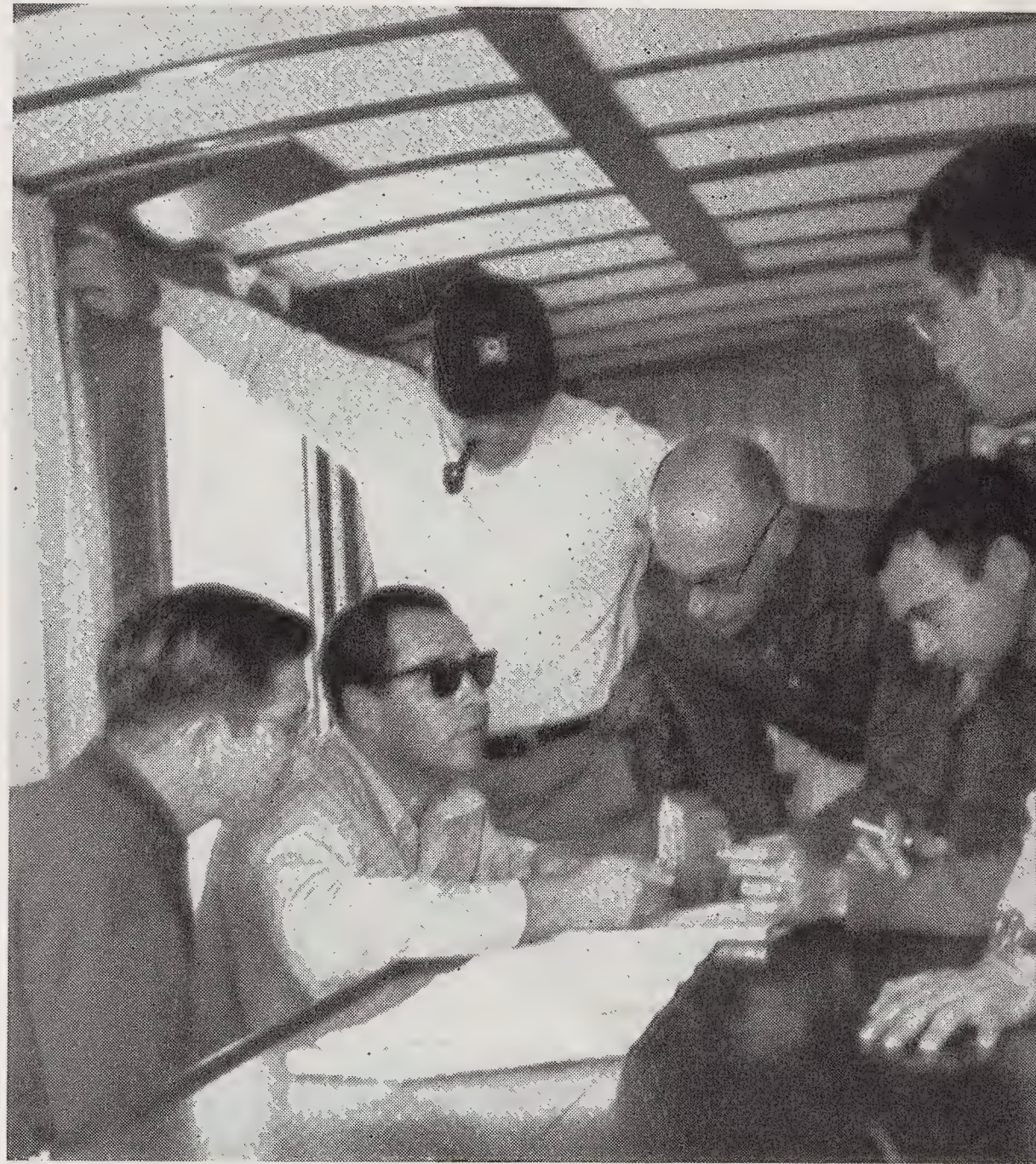
Government and urging that it do something along these lines.

Late in the winter of 1956-57, Richard Pough of the Nature Conservancy decided it was time that two fellows with strong ideas about the Bahamas ought to get together, so he brought about a meeting between Col. Tolstoy and me. Right then and there the idea of a combined operation, a land-and-sea park in the Exumas, was born.

The trouble was, the period of grace extended by the Bahamian Government for Col. Tolstoy to make his park proposals was rushing toward its end. Col. Tolstoy was having to spend so much time abroad that the park proposals were not jelling — and now they were complicated by the addition of the underwater park idea.

Dr. Fairfield Osborn stepped in at this point and saved the day. Last June, only a week or two before the non-leasing period ended, he wrote to Sir Raynor Arthur, Governor of the Bahamas, and asked for a year's extension to June 30, 1958. The New York Zoological Society would undertake to finance a survey of the Exuma Cays and to submit specific recommendations. Sir Raynor

willingly agreed; generous donations from private sources followed, and in January of this year Col. Tolstoy and I led a survey team to the Exumas. A comprehensive plan is now being written and will be submitted to the Bahamian Government well before June 30.*



THE VEGETATION of the Exumas is lush and in some ways really spectacular. Sergeant's palm, a small relative of the majestic royal palm, flourishes in suitable places. Dildo cactus, one of the Opuntias, rises as much as ten feet above the sandy high ground, and in low wet spots we found bromeliads growing in association with occasional Bahamian spray orchids, *Epidendrum*.

Mangrove swamps laced by tidal channels occupy the center of many of the cays and here are Lemon and Nurse Sharks, Sting Rays, Jacks, Snappers and Mojaras. One of these swampy

* The survey team was composed of Oris Russell, Director of the Bahamian Department of Agriculture and Marine Products; Robert Allen of the Audubon Society; Dan Beard of the U. S. National Parks Service; the Hon. Herbert McKinney, a former member of the Legislature in the Bahamas; Dr. Jack Randall, ichthyologist of the University of Miami's Marine Laboratory; Dr. Donald Squires, coral specialist from the American Museum of Natural History; John O'Reilly of *Sports Illustrated*; Russ Kinne, a photographer; Col. Tolstoy and myself.

midlands looked as if it would be excellent Flamingo territory. It happens to be on Norman's Cay, which is just outside the proposed park area. Norman's offers the best anchorage in the vicinity and probably will be developed as a marina. It was here, incidentally, that Dr. Squires found a fascinating fossil coral reef.

As for bird life, the cays have few permanent residents although among these are the pretty and endearing Bananaquits and Wood Star Hummingbirds. Tropic Birds and Royal Terns skim the water near shore and Ospreys are found here. Probably the most sought-after bird is the large and spectacular Crowned Pigeon that is being shot in increasing numbers for food and sport. It has disappeared from many of its former haunts but it responds rapidly to protection and it could be brought back.

There is a nice little herpetofauna, but no venomous snakes. The commonest snake is the Bahamian Racer, *Alsophis vudi*. Who would expect lizards so tame they come to be fed from the hand? The Curly-tailed Lizard, *Leiocephalus carinatus*, does. The largest lizard is *Cyclurus figginsi*, which reaches a length of four feet. Unfortunately it is good eating and is declining in numbers, and one of the conservation aims of the

project is to save it from extinction and to introduce it on cays where it is no longer found.

Sea turtles have not fared well. The Green Turtle is supposed to have been the major dietary factor in the opening of the Caribbean a few hundred years ago but it is only occasionally found in these islands now. The inferior Logger-



Just how different the vegetation is to leeward is illustrated here, where John O'Reilly of "Sports Illustrated" is taking a serious view of slogging along a path through a high thicket.



The Hon. Herbert McKinney, former member of the Bahamas Legislature, leads the survey party through scrubby brush, typical of the windward side of a cay. Leeward it is quite different.



out of sight, out of mind. But now we can see and visit the underwater world quite easily by the use of modern diving equipment and hard facts begin to stare us in the face. A policy of marine conservation must soon be formulated, and it should not be much different from the regula-

Cyclurus, the largest lizard on the cays, reaches a length of 4 feet. Unfortunately it is good eating, and is being wiped out.

Loggerhead Turtles are now the main ingredient of island stews. Green Turtles used to be favorites, but are now rarely found.

head is the main ingredient of island turtle stews nowadays. The Hawksbill is again being heavily hunted for shell and food and may be on the way out, although it is not in immediate danger.

Conch, once the pride of the Florida Keys but vanished now, is still plentiful in the shallows around the Exumas. Large ones are scarce. Conchs have a white, chewy flesh best eaten in fritters or raw in a peppery salad. The natives say conch is too strong for northern blood, but they are making heavy inroads on this big marine snail for their own tables and for the souvenir shell market.

Lobsters and large groupers are in parallel case. Under heavy fishing these inhabitants of the reefs cannot stand the pressure and soon disappear — which is why divers and photographers have to go so far afield to find impressive quarry.

It is a prime aim of the Exuma Cays Park Project to set up reasonable regulations for the protection of underwater resources. So far there are few laws and virtually no licensing anywhere in the world that regulate underwater hunting — or even commercial marine fishing. We just take . . . and take . . . and keep on taking without perceiving or at any rate admitting that the most productive realm in the world, the waters of the continental shelf, can be *and are being* rapidly depleted. Maybe there was some excuse for it in earlier days when we couldn't see below the surface —

tions that apply to land animals: protected species, protected areas, size and bag limits, licensing of fishermen.

There are areas of resistance to all these ideas, but they do not change the fact that regulation is becoming more necessary every day. The Exuma Cays Park Project team will recommend legislation that can be applied in the Bahamas and used as a guide elsewhere.

It would be of little value to talk about the necessity of conservation without offering concrete proposals for setting up the park where conservation would be applied. At our final meeting in Nassau we were fortunate in having the Hon. Godfrey Higgs with us; he is a leading lawyer and a member of the Upper House of Legislature who has long been interested in such projects as this one. To the project he contributed legal advice and moral support — and above all a most valuable precedent for the establishment of a Bahamian National Park System. In 1907 the British Parliament passed the National Trust Act which stated:

"The National Trust shall be established for the purposes of promoting the permanent preservation for the benefit of the nation of lands and tenements (including buildings) of beauty or historic interest and as regards lands for the preservation (so far as practicable) of their natural aspect, features and animal and plant life."

The National Trust was set up as an incorporated, non-profit, dues-paying Association with

several grades of members. In it was vested title to lands and the power to raise funds for the management of park property. All this was to be done with the cooperation of the government, and as any tourist to England can attest, the plan has worked very well. It seems to be tailor-made for the Bahamas.

Here is how a Bahamian National Park Association might work.

After the survey report with its recommenda-

has been cut, the reefs stripped of conch and lobster and even coral. Neon lights have faded the sunsets and a superhighway cushions travelers too unadventurous to see the keys except from a speeding car. Even now bulldozers are at work around the last outpost of the Key Deer.

The Exumas are less remote from such a fate than we may think. They, too, are a small chain of islands encircled by crystalline beaches and shielded from the elements and erosion by tropi-



tions is submitted to the Bahamian Government this spring, private persons including scientists and specialists in park management would be asked by the government to form an incorporated Association. The first duty of the Association would be to take over the financing of the Exumas National Park, which up to then would have been handled by the New York Zoological Society through donations of interested persons.

* * *

Western man has learned to use nature but not to love it. Look at the Florida Keys. The timber

cal vegetation, surrounded by the wealth of the sea — just as the Florida Keys once were.

If the Exuma Cays National Park comes into being, the Bahamas will be the first to set up a true land-and-sea park to break down the false barrier of the shoreline as the border between two worlds. Recognition on a national level that the land and the sea are interdependent — a thing long known to science — will be a major step forward, I believe. No longer will we have one set of rules for the land and another for the immense but not inexhaustible sea.

The Not-so-frightful Copperhead

By JAMES A. OLIVER

THE COPPERHEAD is one of the most widely feared and most greatly maligned snakes in the United States. While there is *some* basis for its unsavory reputation, the facts do not substantiate the deadliness so often credited to it. The mere report that a Copperhead has been seen in the neighborhood is enough to strike terror into the heart of many rural inhabitants, hunters and fishermen. Several woodland recreation areas in the eastern United States have local sections posted with signs warning the unwary to "Beware of Copperheads." These are enough to send some persons scurrying back to their far more dangerous automobiles and the concrete canyons of their familiar urban haunts. The signs are meant to caution the careless individuals, not to terrify the timid. Certainly the true nature of the Copperhead demands only caution and not trepidation.

The name Copperhead is applied to a number of quite different snakes in several parts of the world. In the United States, for example, people in northwestern Oregon apply this name to the harmless Red-spotted Garter Snake (*Thamnophis sirtalis concinnus*). In the southern Great Lakes region the equally harmless Western Fox Snake (*Elaphe vulpina vulpina*) is often called a Copperhead. Fortunately the real Copperhead of the United States does not occur in the same regions as these two harmless species, so no serious confusion results. However, some of the fearful reputation of the venomous Copperhead is transferred to its harmless namesakes.

The true Copperhead of the United States is a Pit Viper of the family Crotalidae and is known scientifically as *Ancistrodon contortrix*. The generic name is sometimes spelled *Agkistrodon* and comes from the Greek for "fishhook tooth," referring to the enlarged, hollow fangs in the front of the mouth. There is a single species of Copper-

head represented by four geographic races or subspecies. These are:

Northern Copperhead (*Ancistrodon contortrix mokeson*) — occurring in upland areas from Massachusetts south to northeastern Alabama and west to eastern Oklahoma.

Southern Copperhead (*Ancistrodon contortrix contortrix*) — occurring in lowland areas from southern Maryland along the coastal plain, up the Mississippi Valley and west to eastern Texas.

Broad-banded Copperhead (*Ancistrodon contortrix laticinctus*) — occurring from south-central Texas north to southern Kansas.

Trans-Pecos Copperhead (*Ancistrodon contortrix pictigaster*) — occurring only in the Trans-Pecos area of Texas and probably adjacent Mexico.

The four races are distinguished most readily by their color patterns, as seen in the accompanying photographs. Where their geographic ranges come together, intergradation may take place and one pattern merges into another. In the southwestern portion of the range the exact distribution and identity of the races is complicated. Individuals occurring where two or more subspecies meet may exhibit the pattern of either form. The pattern and scales beneath the tail are the most noticeable variations from place to place, but the races also appear to vary in size. The Trans-Pecos Copperhead seems to attain a maximum length of only two feet, whereas the Northern Copperhead has been recorded at a maximum of four feet, five inches. Any Copperhead over three feet in length is unusually large.

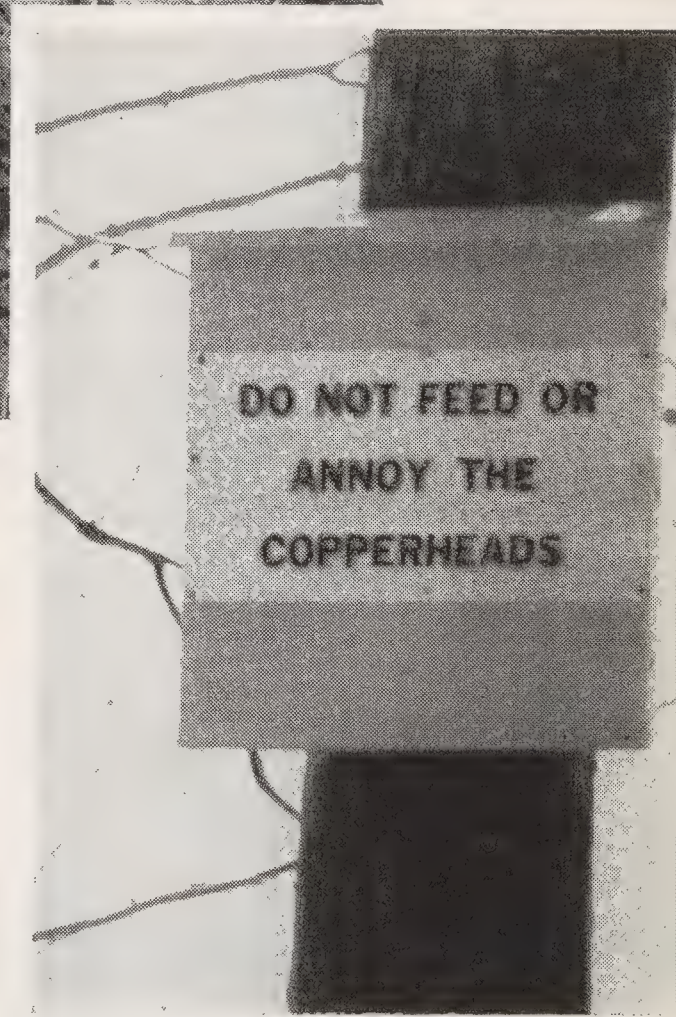
Copperheads characteristically inhabit rocky woodland areas, although they are sometimes found in grasslands, cultivated fields and marshes. In some localities there may be a short seasonal migration from upland rocky woodlands, where



the winters have been spent in hibernation dens, to lowland marshes in the summertime, with a return to the uplands in the fall. In other places there may be little movement other than that required to get food. In any case, these snakes are seldom found far from woodlands. In western Texas where Copperheads occur in a relatively dry and sparsely vegetated region, the Trans-Pecos Copperhead is found in the live oak groves along creeks and rivers where a constant source of water is present. The snakes are almost invariably in a dry situation, but rarely far from water. In the warm summer months they are likely to be seen along the banks of streams. A few have been found actually swimming in the water and I know of a very small one found swimming in the middle of a river approximately 200 yards wide.

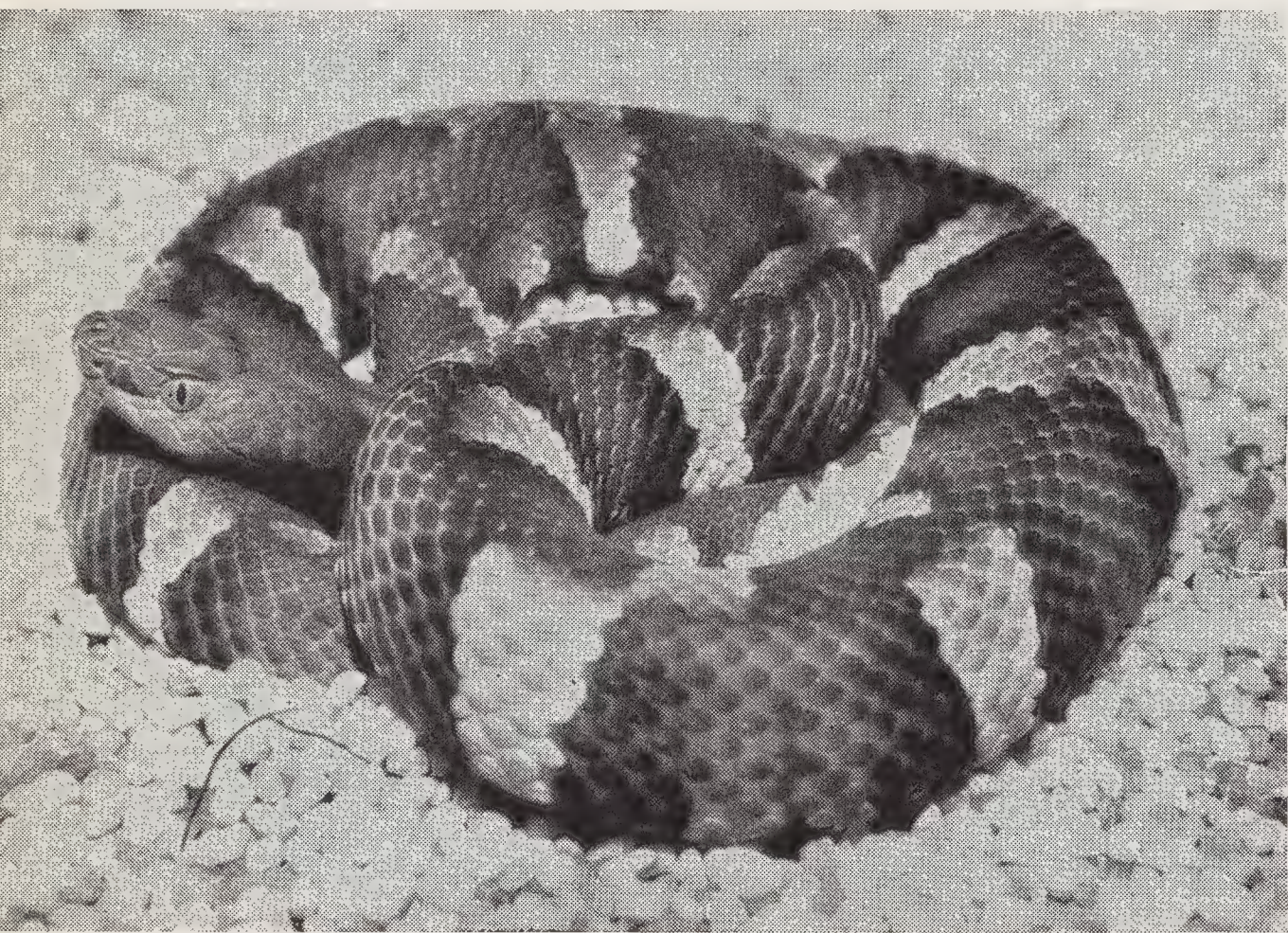
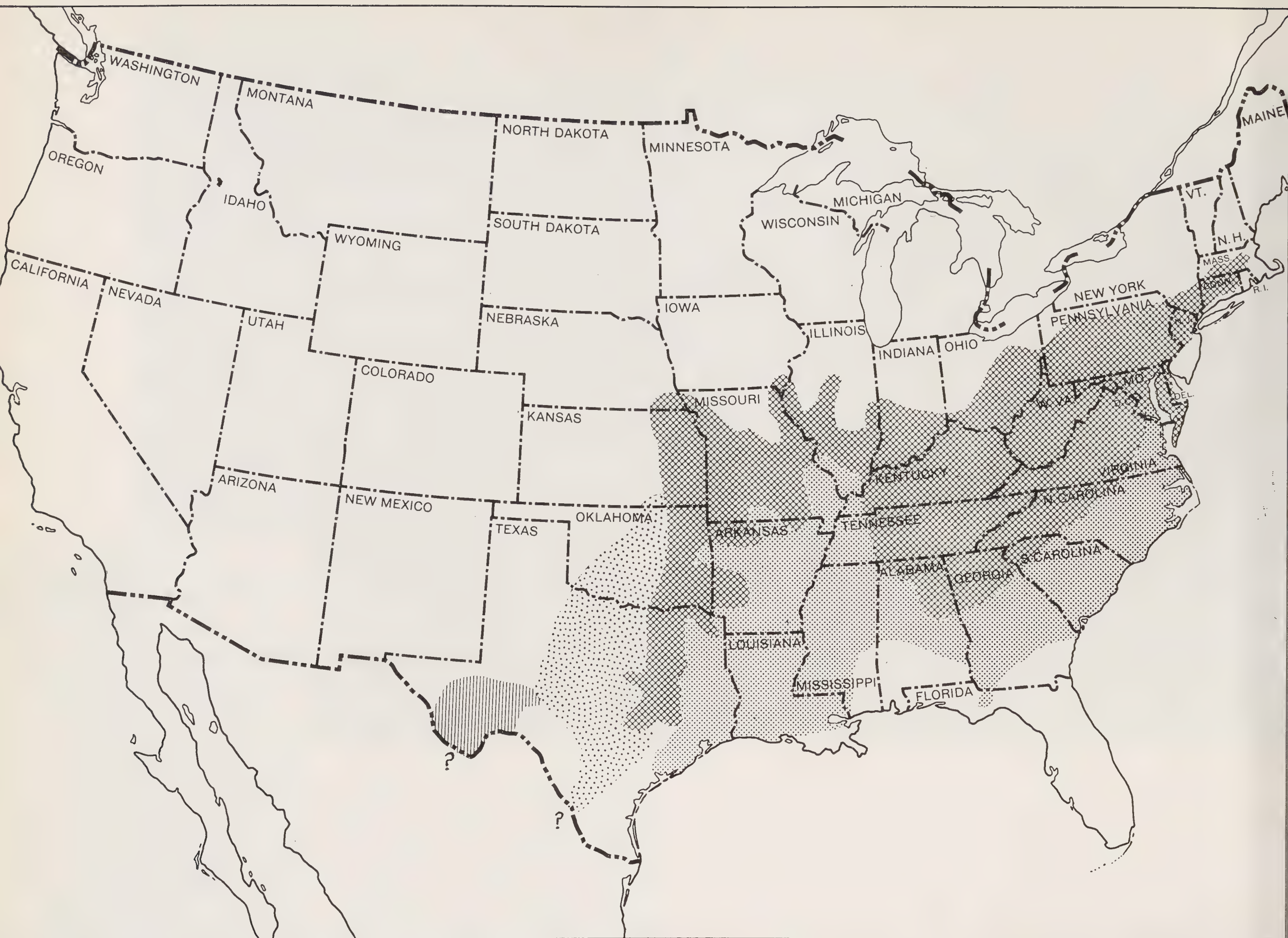
Throughout the geographic range of the species its abundance varies sporadically. In a large part of the country individuals appear to be widely scattered and it is difficult to find many at any one time. In other areas they may be concentrated in restricted localities and can be found in large numbers. This is particularly true where large numbers congregate around the hibernation dens in the spring and fall, but may also be true of some localities at all times during the season of activity.

One of the best Copperhead dens in the New York area is in this rock formation in the Mianus Gorge, where visitors are warned not to "feed or annoy" the snakes. Copperheads are quite common in the Gorge.



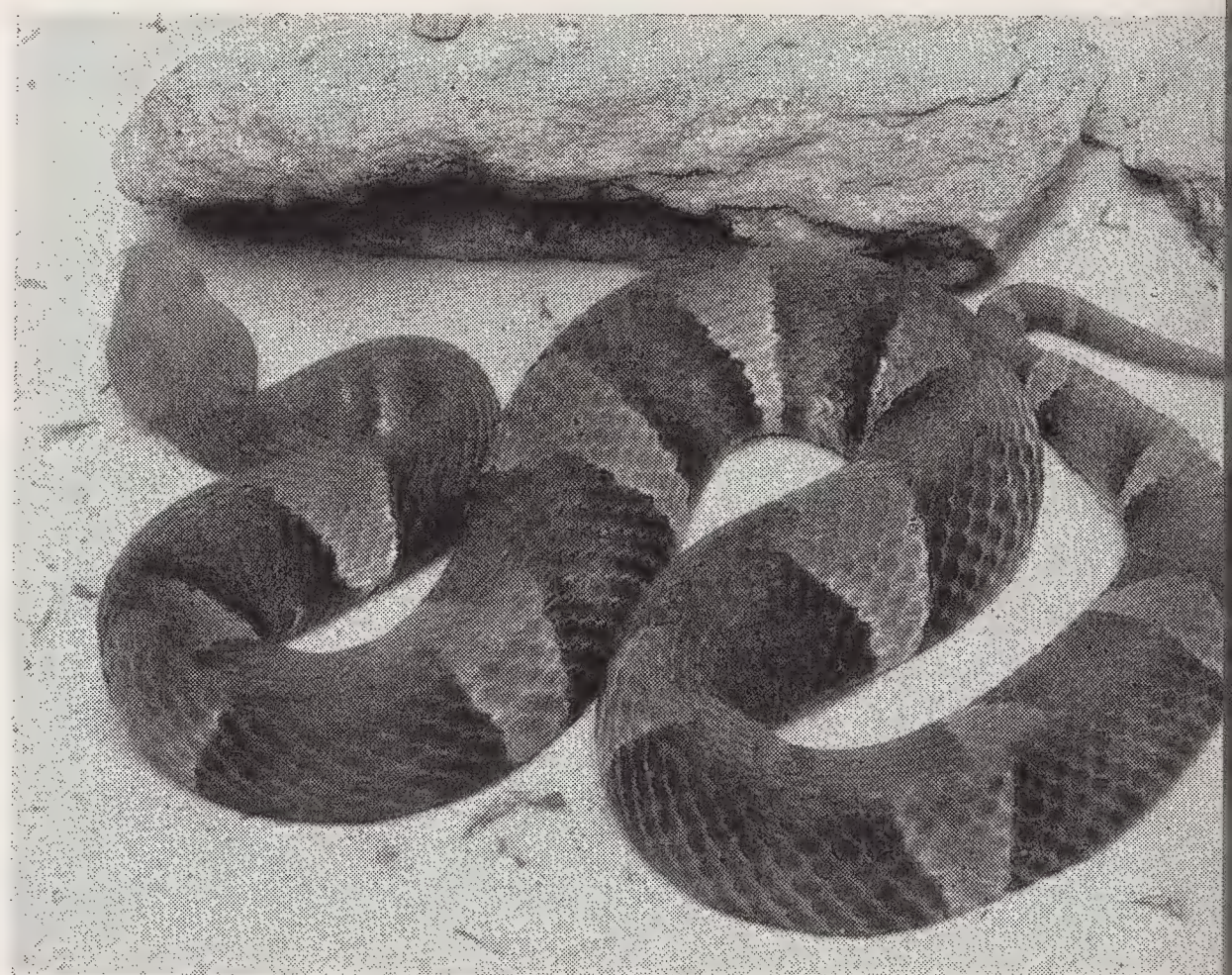
When the Trans-Pecos Copperhead was described in 1943, a total of only five specimens had ever been collected. In the summer of 1949, a group of students from the University of Texas collected 90 individuals between June 4 and July 9. Robert McCauley, Jr., reports one occasion when 37 Copperheads were found in a manure heap in a barnyard.

Like the Timber Rattlesnake, as well as many harmless snakes, the Copperhead has been exterminated in numerous places as a result of man's activities. However, the Copperhead is able to survive in cultivated rural areas better than the rattlesnake. In fact, the Copperhead is often found around and in farm buildings where it comes to feed on mice. Numbers of individuals are found under shocks of grain and piles of hay in fields bordering woodlands. In the vicinity of

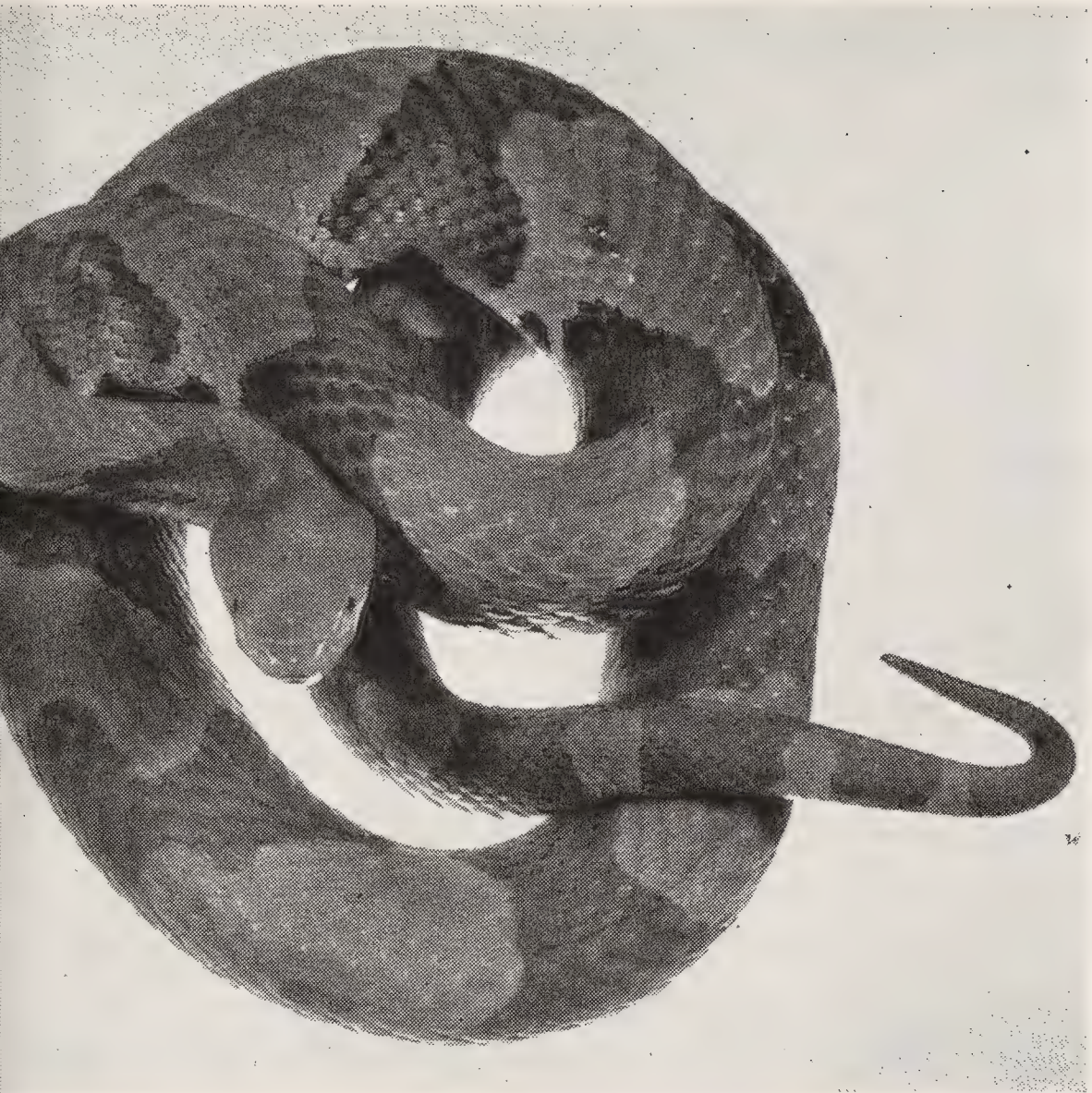


TRANS-PECOS COPPERHEAD. The bands are quite broad and tend to have light centers toward the lower part of the body. Range of this race is the most restricted, although it probably extends into adjacent Mexico. It was not described until 1943.

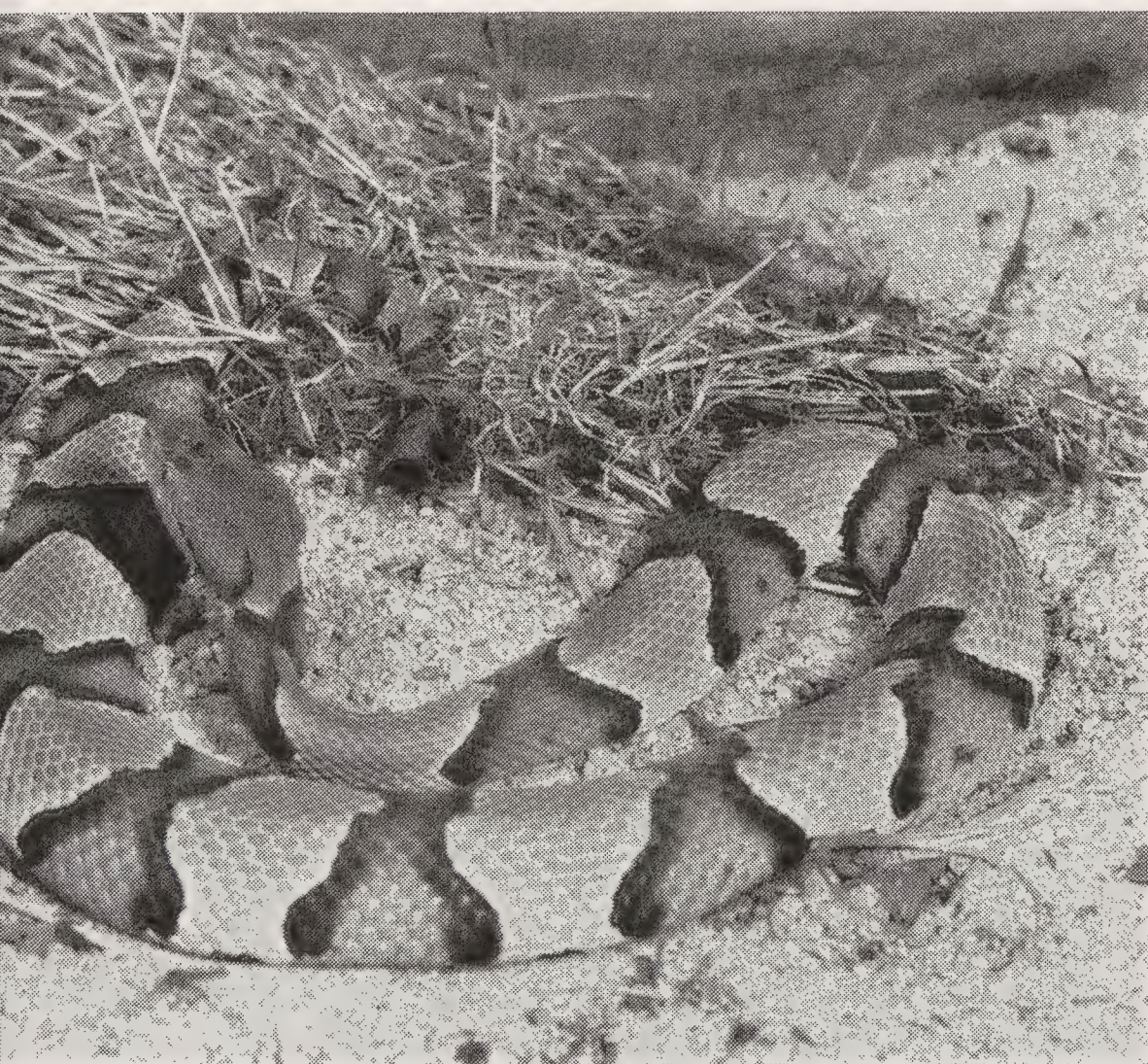
Photo by Charles Hackenbrock



BROAD-BANDED COPPERHEAD. Very broad bands, not interrupted along the middle, nor showing light centers toward the bottom are characteristic. This race and the Trans-Pecos Copperhead seem to be smaller than the other two forms of wider range.



NORTHERN COPPERHEAD. *Largest of the four races, recorded at a maximum of 4 feet, 5 inches, more than twice that of the Trans-Pecos Copperhead. Its distribution includes the most heavily populated parts of the U. S. It is the local Copperhead.*



SOUTHERN COPPERHEAD. *Lightest-colored of the four races. There is often a tendency for its bands to be completely interrupted along the middle of the back, and it is probably the most handsomely marked of all. It is usually found in coastal lowlands.*

New York City, Copperheads formerly occurred in the Bronx and across the river in Fort Lee, N. J. Today the nearest localities where they can be found are in northern Westchester north of Valhalla and Tarrytown, and in northeastern Bergen County, N. J., north of Alpine. The official historian of the Bronx and an excellent all-around naturalist, Theodore Kazimiroff, tells me that the last Copperhead recorded from the Bronx was caught in 1936 in the northern part of Pelham Bay Park within the city limits of New York City. In 1954 a single individual was killed in the Greenbrook Sanctuary in Alpine, N. J., within sight of New York's skyscrapers. With the increased building activities and the clearing of the woodlands, fewer and fewer snakes of any sort will be found in and around the metropolitan area—and this will be just dandy with many persons. However, naturalists regret the passing of all forms of life and the resulting disturbance to the natural environment. Fortunately there are a few tolerant and far-sighted individuals who are endeavoring to preserve some wilderness areas *completely* undisturbed.

Among these are the Mianus River Gorge Conservation Committee of the Nature Conservancy. This group is dedicated to the "preservation of the virgin forest and abundant wildlife along the Mianus River" in New York and Connecticut. It wants to preserve *all* the wildlife—including the snakes—and it is doing a splendid job of saving this magnificent area for all to enjoy. Copperheads are among the reptiles living along the Mianus Gorge and visitors are warned to walk carefully where they are known to occur. There is a Copperhead den currently used by a number of snakes on the adjoining property of one of the Board members of the Committee. He has posted printed signs warning visitors not to disturb the snakes: "Do not feed or annoy the Copperheads."

The Gorge is about 30 miles from the city limits of New York and offers an excellent opportunity to study animals under natural conditions. Few studies have been made on snakes in the wild and the Reptile Department welcomes the chance to carry on investigations in the Gorge. Last year we started a program of marking each snake found there. Subsequent recaptures of the

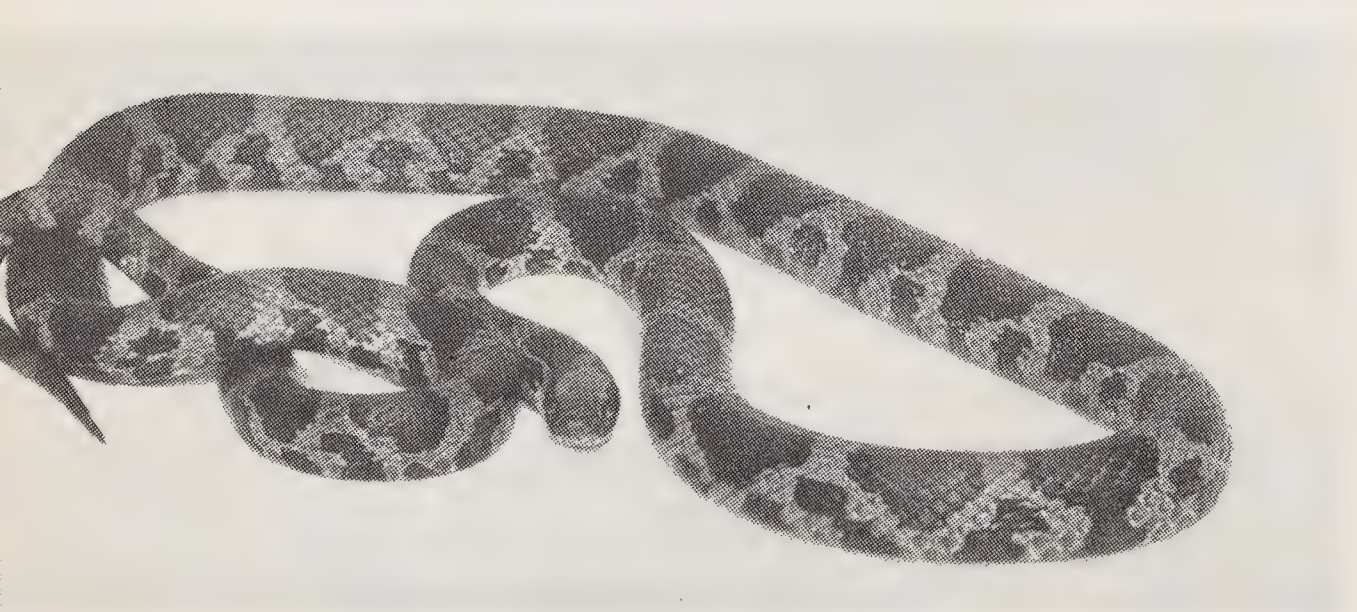
marked individuals will tell us much about their habits and activities. Eventually we should know how large the population is, its structure, how long the individuals live, how fast they grow, how far they travel, and many other interesting bits of information.

Some studies have been made on Copperheads in other parts of the United States and we know something of their habits from these. For example, Henry S. Fitch has been studying them in northeastern Kansas. In that region they are common but not often seen in the open because of nocturnal habits and their effective concealing coloration. Individuals may be active from the middle of April until the middle of November. Dr. Fitch says that most Copperheads found in the open were taken at the beginning or end of the season, or else in early morning and at dusk, or on cool, cloudy days. Clement S. Brimley has reported the monthly variations in the number of snakes caught near Raleigh, North Carolina. The largest numbers of Copperheads were recorded in June, July and August, with a large number again in October when the young are born. Adequate information is not available for New York, but the data so far suggest a situation more like that

reported for Kansas than the one observed in North Carolina. More Copperheads are seen here in early spring and fall, with few encountered in the summer.

During the warmer periods of the summer, Copperheads remain inactive or move about only in the early morning or at dusk, but I do not know of many being found abroad after dark in the New York area. Farther south I have found them to be more crepuscular (active at dusk) than nocturnal. However, where the summer temperatures are extreme, they are forced to become active only at night. In Fitch's studies he found the Copperheads active in the open at air temperatures between 53° and 90° F. Their body temperatures were between 64° and 94° F. It would seem likely that they would be inactive when the air temperatures are below 50° and above 90° F. At the lower temperatures they are usually basking in the sun, and at the higher they remain beneath shelter or in shade.

Copperheads have been reported to feed on a variety of animal food including insects, salamanders, frogs, lizards, birds and small mammals. In a study of the food of 72 Copperheads collected in Virginia, F. M. Uhler, Clarence Cottam



These are the snakes most frequently confused with the Copperheads. Upper Left — Young Cottonmouth Moccasin. As it grows older it turns darker and the bands are less prominent. Lower Left — The Milk Snake. This is a useful reptile that feeds on mice and rats. Below — The Hog-nosed Snake is mis-identified and killed especially in southern States.



and T. E. Clarke found that small mammals made up more than 50 percent. of the volume of all foods consumed. Amphibians comprised 12 percent. and insects made up 24 percent. of the total volume; most of the insects were moth larvae. W. J. Hamilton, Jr., and Joseph A. Pollock made a similar food study of 16 Copperheads collected at Fort Benning, Georgia. They expressed the different types of foods in terms of the frequency in which they had been taken. Mammals were eaten most frequently (46 percent.), then reptiles (31 percent.), and finally insects (23 percent.). It seems surprising that a venomous snake as large as the Copperhead would utilize such large numbers of insects in its diet. However, adults have been found with their stomachs crammed full of recently emerged cicadas.

Copperheads are viviparous, giving birth to 1 to 17 young in late August, September or early October. The young are 8 to 10 inches in total length and the tail is prominently sulphur-yellow in color. The closely related Mexican Moccasin or Cantil (*Ancistrodon bilineatus*) is known to use its yellow tail as a lure to attract small animals for food and it is sometimes stated that young Copperheads do, too, but this has not been confirmed. The youngsters shift for themselves as soon as they are born and are capable of inflicting a venomous bite shortly after birth. It was long thought that they were capable of inflicting a venomous bite immediately after birth, but experiments have shown that this is not always true. Nevertheless, at least some of them can give a venomous bite within a few minutes to several hours after birth. The snakelings shed their skins 3 to 10 days after birth.

In disposition most Copperheads are quite mild and inoffensive. I know of many instances when human beings have stepped over or beside resting snakes or put their hands close to them without being bitten. And yet they have a sinister reputation. How can such mild-mannered snakes be responsible for so many bites on human beings? The answer is paradoxical: the Copperhead is the victim of its own effective concealment and its habit of remaining motionless unless touched. If it had the conspicuous disturbance reactions of the rattlesnakes, or even the Cottonmouth Moccasin, perhaps few persons

would get close enough to be bitten. In strict fact the Copperhead bites only in self-defense and does not have a long striking range, compared with many other pit vipers.

Several attempts have been made to record the number of snakebites occurring annually in the United States, and to correlate the different kinds of snakes with the fatalities. It is extremely difficult to get reliable figures and the available information is certainly incomplete and often inaccurate. For example, many snakebite accidents take place far from settled areas and the treatment frequently consists of folk-remedies — or there may be no treatment at all. Only the more serious cases or those occurring close to settlements get reported. Even in these, the identity of the snake is often unknown or uncertain. I know of two instances of bites by young Cottonmouth Moccasins that were reported as Copperhead bites. Juvenile Cottonmouths *do* look somewhat like Copperheads and the two can be confused easily. Similarly, if a rattlesnake fails to rattle before or after it bites, a frightened and unobservant person may assume that it is a Copperhead or a Cottonmouth.

Nevertheless, within limitations we can get some indication of the relative seriousness of a Copperhead bite. Dr. Prentiss Willson assembled information on 740 cases of snakebite reported prior to 1908. Of this number, 17 percent. or 97 were attributed to Copperheads, with 72 percent. being reported for the various species of rattlesnakes. Five of the Copperhead bites resulted in fatalities. Two of these victims were young boys, 6 and 9 years old, and who were given no treatment in one case and improper treatment in the other — both died unnecessarily from secondary complications. The remaining three fatalities occurred in adult men, who died from over-enthusiasm for the treatment. Dr. Willson said, "in every case the amount of bad whiskey taken by the patient was considered by the reporters to have been a deciding factor in the fatal outcome." He goes on to say, "it is very doubtful if the bite of this species is ever fatal to adults in uncomplicated cases."

Between 1928 and 1934 the Antivenin Institute of America was able to get records of 2,376 snakebites in the United States. These records were based on reports by attending physicians and on

newspaper clippings. A total of 692, or 29 percent., was attributed to the Copperhead and six, or 0.9 percent., resulted in fatalities. We know little or nothing about the details of these cases, but they are subject to the same uncertainties as those mentioned above. The figures indicate that the Copperhead is responsible for more bites than any other single species of venomous snake, but that fewer than 1 percent. of the bites result in death. The number of fatalities from snakebite has doubtless decreased in recent years with the greater effectiveness of modern treatment. And, as someone has remarked, the frequency of snakebite has greatly diminished since whiskey is no longer officially recommended as *the* treatment for this misfortune!

On the basis of the available evidence it seems safe to conclude that today the bite of the Copperhead is not a serious matter for an adult or even for a child weighing more than 50 pounds. If an unusually large Copperhead bit a small child, it might cause dangerous consequences, although it is impossible to predict with accuracy the seriousness of a bite by a venomous snake; there are too many variables. But it does seem safe to say that the bite of a Copperhead is rarely fatal to an adult, whether treated or not. This does not mean that the bite of this snake should be taken lightly. Any bite by a Copperhead should be given prompt and thorough treatment. It probably will be a distressingly painful experience, but is not likely to be a fatal one.

As I pointed out above, an important factor in the frequency of Copperhead bites is the snake's concealing coloration. Thousands of Copperheads are passed unnoticed in the woods every year. Probably most of these snakes are not discovered until they have bitten the intruder because he stepped on them, or alongside them, or put his hand on them inadvertently. There are, of course, exceptions to the statement that they are always well-hidden. A Copperhead crossing a paved road, basking on a rock in the sun or uncovered beneath a shock of wheat is conspicuous, but these are not the situations in which people get bitten.

Many persons accept without question the belief that a Copperhead is always resting quietly waiting for a chance to sink its fangs in human flesh and that it is an aggressive, vicious snake.

These suppositions are unwarranted and untrue. When given a chance, the Copperhead, like virtually all snakes, will try to escape. I had this demonstrated clearly twice in one day last fall in the Mianus Gorge. I encountered two Copperheads at different times crossing my path. Both snakes immediately crawled off into the underbrush and it was only with difficulty that I caught them for examination.

The sinister reputation of the Copperhead has unfortunate repercussions on two harmless snakes occurring in the same general region and frequently mistaken for the Copperhead. They are the Milk Snake (*Lampropeltis doliata*) and the Hognose Snake (*Heterodon platyrhinos*). In the vicinity of New York City approximately 90 percent. of the "Copperheads" sent or brought to the Bronx Zoo for identification prove to be Milk Snakes. The two snakes really look nothing alike when their color patterns are examined. The Milk Snake feeds primarily on mice and is a beneficial snake deserving protection. The Hognose is mistaken for the Copperhead more in the southern and central United States. When disturbed it puts on a bluff that is far more awesome-looking than anything the Copperhead could do and gives a forceful impression of a dangerous snake. In reality the Hognose is one of the most harmless snakes in the country and can hardly be made to bite. Not only do the snakes suffer from the misunderstanding and unreasonable fear of man — and woman — but the human beings cause themselves great and unnecessary mental distress.

It is no exaggeration to say that there are thousands of people around the New York area alone who are terrified by the possibility of an encounter with a Copperhead. Last year I was consulted by two different persons who were considering selling their homes because of reports of Copperheads on their property. One lived in a section where no Copperheads had been found in twenty years, but a large Milk Snake was killed in her yard by a policeman who said it was a Copperhead. I hope that we can allay some of this fear by reassuring such people that the Copperhead is a greatly exaggerated and much maligned hazard of country life and outdoor activity. The snake should be respected and left alone — not worried about.

Zoo News in Pictures

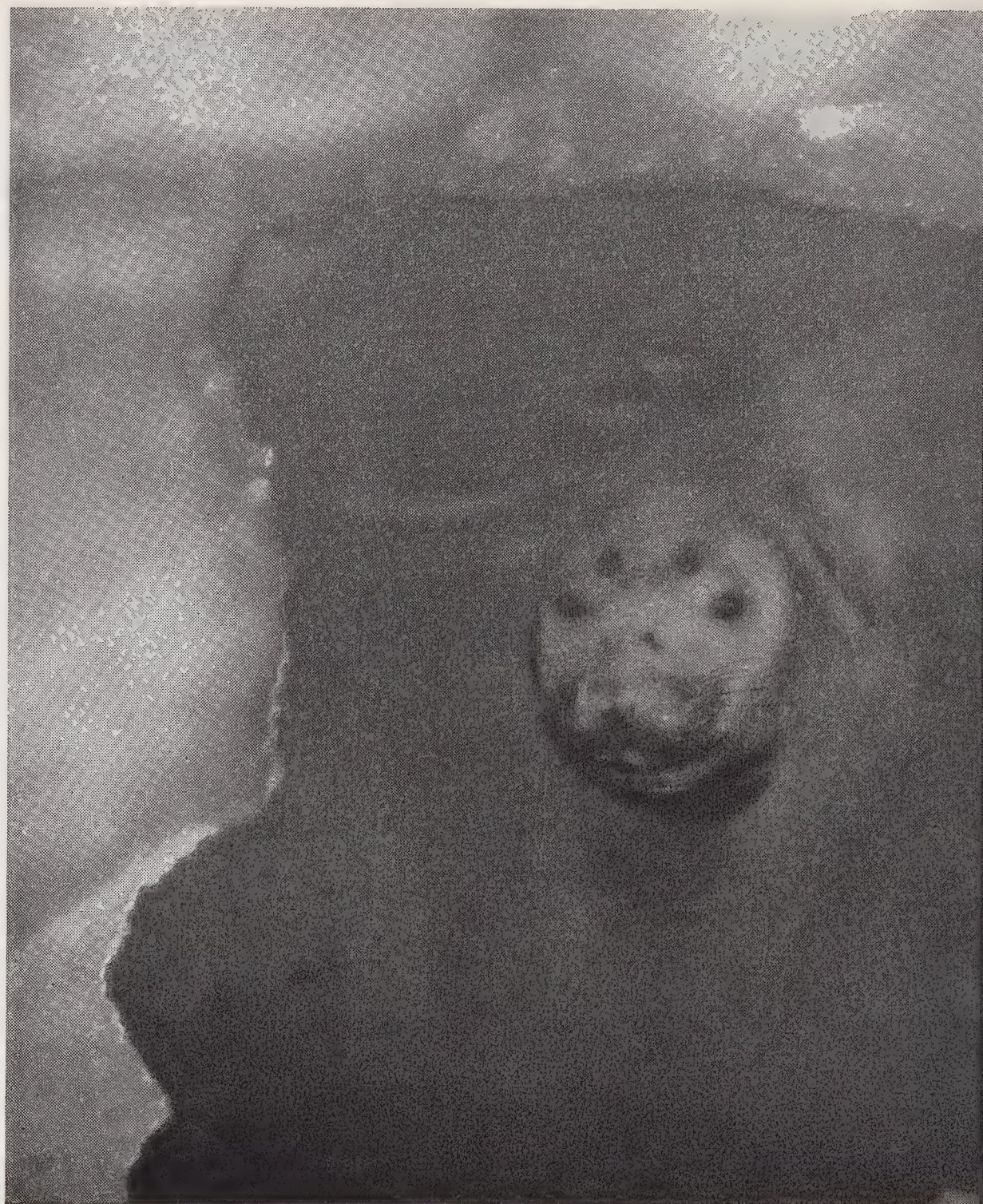
Photos by SAM DUNTON



It is always a pleasant thing to be able to exhibit an animal we have never had before, and doubly so when the animals are as tame and friendly as our new pair of **FERRET-BADGERS**. They are, indeed, so gentle that they must have been pets of someone, but we know very little about their life before they came to us — not even exactly where they came from, although they are said to have come from French Indo-China. Ferret-Badgers are nocturnal in the wild; ours sleep a good part of the day but are certainly alert enough to come popping out of their sleeping box at the slightest disturbance, ready to frolic and feed. They are supposed to eat a wide variety of things: small mammals, birds, fruit and insects. Ours have so far steadfastly refused fresh fruits, but will take carrots and sweet potatoes. They particularly like chopped meat sprinkled with bone meal, codliver oil and dried dog-food meal.



This (as animals know as well as people) has been a hard winter. During the extremely cold spell in February **DUCKS AND GEESE** on the Wildfowl Pond found their open water area more and more restricted each day and a few times we found the birds actually frozen to the ice. Hay was scattered widely to make the birds more comfortable. The **ELEPHANT SEAL** and the **SEA LIONS** kept a mere blow-hole open in their pool. And as for the **POLAR BEARS** — they thoroughly enjoyed it.



This fuzzy apparition is a **BRAZILIAN TURKEY VULTURE** photographed at about the only stage when a Turkey Vulture is really appealing. The baby was brought from Venezuela by former Head Keeper of Birds George Scott, who returned in March from Caracas where he helped build and stock a Zoo.



Among the interesting current exhibits in our Jewel Room in the Bird House is this **NATAL STRIATED COLLYBIRD**, from Africa. A stereoscopic light happened to catch it in full flight, but often it is seen in a posture that gives it the name of Mousebird — creeping mouselike on a tree.



In Africa You May Have

Hornbills in the Garden

By LAWRENCE KILHAM

Professional Virologist & Amateur Ornithologist

THE SHORES OF LAKE VICTORIA in equatorial Africa are a paradise for the bird-watcher and much of my spare time during the year I lived with my family in Uganda was spent observing the lives and habits of Black-and-white-casqued Hornbills, possibly because a pair of these spectacular birds gave us an early introduction to themselves by carrying on courtship in our Entebbe garden.

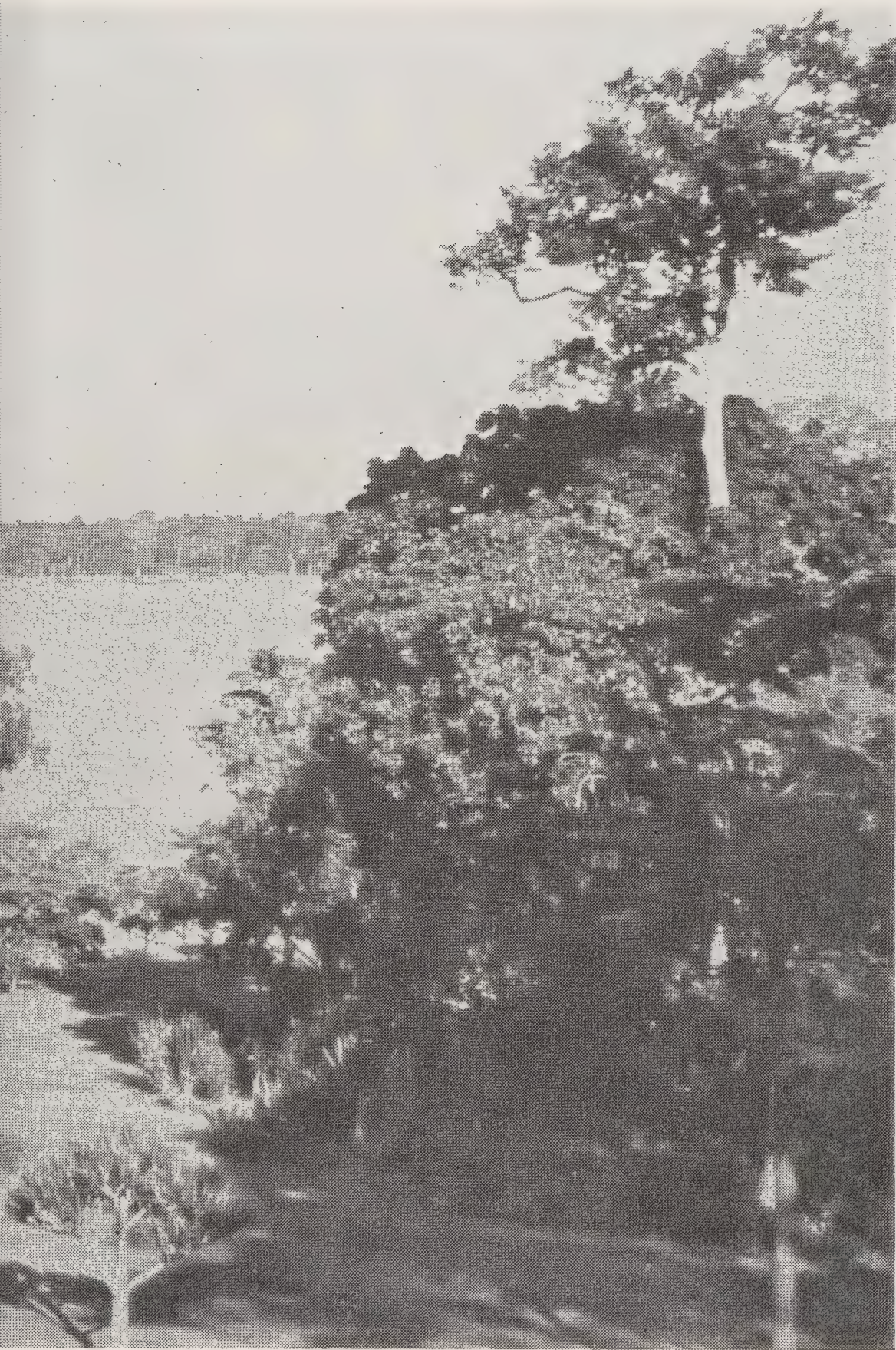
Casqued Hornbills were conspicuous about Entebbe. As among most hornbills, the female has the amazing habit of cementing herself inside a hollow tree during the nesting season. Here she lays her eggs and rears her young to full size while depending on her mate to bring in food. This arrangement demands the closest kind of cooperation and devotion and makes hornbills, for a student of animal behavior, one of the most interesting of birds.

Most of my hornbill watching was carried on at Mpanga. This patch of forest, with a network of trails cut by the forestry department, was almost a last refuge for hornbills. Remnants of



forest elsewhere were fast disappearing to make room for more Buganda, with their bicycles and bananas. On my first visit to Mpanga, the forest seemed desolate until I came by an unusually large and beautiful tree which grew by a crossing of two main trails. Six feet thick at the base, its trunk of smooth bark rose seventy or more feet before dividing into huge limbs, most of them overgrown with cabbage ferns and other epiphytes, and supporting long lianas which drooped

down to the forest floor. A male hornbill was perching above a broken stub on a large limb. His mate was in the cavity below him, walled in with cement which left her only a slit one to two inches wide and eight inches long through which to view the world. I was excited to see the tip of her beak moving about inside. The male was an odd-looking creature. He was over two feet long and had a huge beak, made impressive by a forward-projecting casque. Back by the headquarters clearing, I was fascinated to discover a



second pair of hornbills cementing the wall of their nest hole, and I returned on successive week-ends to watch the process of construction. The female would remain inside the hole for an entire morning while her mate perched just outside. I could hear her bill tapping against the cement. She made a rapid, vibratory tapping with the side of her bill tip, proceeding with infinite patience. The male's job was that of a bricklayer's helper. Every so often he would give a heave and



Above — “Mpanga,” the hand-reared Casqued Hornbill, at the age of 2 years. His bill is very much larger than that of the female, “Zika,” at the lower left. The center picture shows the Entebbe Botanical Garden on the shores of Lake Victoria. Arrow points to nest site on the arched limb of a tall tree.

All photographs by the author

pop a mud pellet from his gullet to his bill tip. Then he would bend down to give it to his mate. She might take ten pellets, one after another, then continue the plastering. The pair were so engrossed in their work that they made little noise. Occasionally the male would beat his way to the forest clearing and swoop down among the native huts. I was keen to learn what he might pick up for building material. On one occasion he landed behind the forest ranger's house. Using this as cover, I ran up quickly, then worked my way around behind a patch of corn. The male was perched on a low stump thirty feet away. Mid-morning sunshine brought out a bluish tinge in his black feathers as his huge head swung down to pick up chunks of dry earth and swallow them. Meanwhile his mate had left the nest to perch by the clearing. He flew up and fed her eleven pellets, which she swallowed before flying over to a paw-paw tree. I now went over to look at the stump. The male hornbill had torn open a termite nest, for I could see that soldiers had rushed out to stand guard and workers were now swarming up to rebuild the broken tunnels. Here was a discovery! These hornbills, as I found on subsequent occasions, used termite earth for their



casqued and pied hornbills. The center of their alarm was a magnificent Hawk-eagle, perched just below the forest canopy. When it had flown away I found myself in a new area of the forest and I listened intently for what other birds might be there. Then I heard some tapping. Walking carefully along a trail I discovered a hornbill nest which was unique in my experience, for it was only thirty feet from the ground. I developed a plan within a few moments. All other nests had been located about eighty feet above the ground, well beyond any hope of reaching them. This one was within reach. Fetching the African forest ranger, I showed him that by tying ladders together and using poles for a scaffold, we could climb up to this nest whenever we wanted to.

Left — Entrance to the nest cavity, showing the wall of cement-like termite earth and the feeding slit.
Right — The termite mound where the author saw the male hornbill getting earth to close the hole.

cement, just as some Africans use it to make floors for their huts. Termites, in building their mounds, select each grain and coat it with glue. This material dries to become as hard as rock.

Some weeks later I spent the night in a native hut at Mpanga. Soon after dawn I walked down a cool, damp, forest trail and in passing below the giant *Toxicaria* tree where I had found my first nest, I frightened away the male, who flew with a terrible noise as though all gears were uncoiled and grinding. Other hornbills were flying back and forth to fruiting trees. Their calls rose in a crescendo, augmented by those of parrots and plantain-eaters. Fifteen minutes later the male had returned to the nest. He perched above the entrance and, swinging his head down each time, he coughed up four yellow fruits which he placed in the tip of his mate's bill which now protruded from between the cement walls. Then he flew to another tree to whack his bill in resounding fashion. His mate thereupon screamed loudly, rattling her bill through the entrance. Possibly he had not brought her enough breakfast. The view from her home in the limb must have been magnificent, out over the tops of the jungle trees. Her mate enlivened her long vigil by returning every thirty to fifty minutes with more fruit.

One morning I heard a commotion among both

Everything was in place on the following weekend. I climbed the swaying ladders with flashlight in hand and looked in. To my surprise there were two white eggs but no mother bird. I pointed the flashlight around at all angles and finally found that she had an escape chamber directly above her nest. Only the tip of her tail was in view. On the following Saturday, which was early in December, the ranger told me that two eggs were there early that morning. As I approached the nest I scrutinized the forest floor. An eggshell lay below the entrance and ants were still swarming over its moist membrane. I climbed to the nest. Inside was a tiny, blue-skinned chick. This was my first view of Mpanga, for such I named him in later months when he came to live with us in Africa and America for nearly three years. The second egg hatched four days later. This chick lived for only a week, doubtless dwarfed from the start by its brother. It seemed to me that these hornbills laid two eggs as a factor of safety, in case one failed to hatch, but that there could never be room in most nest cavities for more than one young one and its mother.

I finally found sixteen hornbill nests, but many of them were too inaccessible for steady watching. Fortunately one was located in the Entebbe



Botanical Garden, where I could readily make observations in odd hours. The nest was in a cavity in the long, arching limb of a *Piptadenia* tree which stood in the open below a steep hill overlooking Lake Victoria. I sat on the hill looking into the cavity with field glasses on a November afternoon. Slanting sun rays illuminated the hole directly and I could see the female tapping rapidly with her bill from the inside. Her mate, whom I called Winnie, flew toward me several times to gather earth from a termite mound. A few evenings later activities of the pair had changed. Winnie now hopped about the tree in a restless fashion, then flew off to return with some fruit. He bent over the hole to feed his mate. By the last rays of the sun I could see that the wall was now complete. Dusk had come as Winnie finally flew over the hill alone, with a great whooshing of wings. I was apparently on hand on the very evening when the female began her long period of voluntary imprisonment. The two hornbills, previously so close together, were now to spend four months apart, seeing little of each other except for brief moments when the male came for a feeding visit. Winnie had flown away, rather dramatically, with the blowing of taps from the police barracks and the rising of a full moon.

The Botanical Garden was pleasantly fresh and cool before breakfast time. Africans walked to work as the sun came up, some of them swinging their hands free as they nonchalantly balanced lawn mowers on their heads. I usually stood by a flowering bush which gave me the best view of the hornbill's nest. Flocks of parrots with short, rapid wingbeats accompanied by mingled whistles and screams had a regular flight from some island in the lake. I might have to wait fifteen or twenty minutes for the sound of Winnie's approach. He was always spectacular. The early sun shone on his black and white plumage and huge casque as he crossed a wide stretch of lawn. Winnie was bringing more than breakfast for his mate. With head held high, his bill was clamped on a short stick which projected out to one side like a cigar. He would sail in to alight on the great arching limb of the *Piptadenia*, then bounce along sideways in clownish fashion until he rested with belly flat on a bole above the nest. Then his head would swing way down to offer the stick to his mate. No food came until it was accepted. Winnie now coughed several times, popping a "cherry" from his gullet to present it to his mate, who might take six or a dozen of them in succession. He gave a chuckle each time his head swung down. Winnie usually bounced

to some other perch after the feeding to whack his bill against the bark. He would then fly off with the same loud whooshing of wings.

My pre-breakfast visits to the Botanical Garden continued over a period of four months. I never tired of seeing Winnie fly to his nest tree with a cigar-like stick protruding from his beak. On an increasing number of mornings I noticed that he was no longer alone. An odd female, whom I called Clytemnestra, would follow him in to alight in the *Piptadenia* while he fed his mate. Who this lady was, I never knew. I did wonder, however, whether seduction was possible among hornbills. Winnie was a free bachelor except for a few brief intervals during the day. It was easy to provide food with such an abundance of fruiting trees and Clytemnestra might edge in on Winnie's leisure time. One morning Winnie seemed to be in doubt. He fed his proper mate, then bounced and hopped upward to where the odd female was waiting for him. Winnie knocked off a piece of bark. In the hornbill's world, presentation of a piece of bark or a stick is a token of affection. Winnie clamped on his piece of bark a number of times until it was nearly broken up, then bounced closer to the intruder. Would he present what was left to Clytemnestra? To my relief he flew back to his big limb, bounced over to the bole and, swing-

ing his great casqued head downward, presented the remnants of bark to his mate. I came to feel that paired hornbills have a tremendous attachment for each other. Their long nesting ordeal would not succeed otherwise. On the other hand a hornbill without a mate must feel especially miserable and possibly this explained Clytemnestra's persistent pursuit of Winnie, which led eventually to a rather dramatic event. Long before this took place Winnie was showing increasing intolerance of his follower. Sometimes he would interrupt his feeding to chase her away. Her persistence was unshaken. When Winnie flew from the *Piptadenia* she would tag along about twenty feet behind. In early March I visited the garden to find that Clytemnestra was more of a devil than I had at first supposed. She had come to the nest alone. Clinging to the outside, she was knocking pieces from the cement wall, then crumbling them in her bill as the remnants fell to the ground. I waited in suspense. After some minutes a whoosh of wings announced that Winnie was coming. He swooped to chase Clytemnestra away, and only then his own mate, silent when under attack, gave way to loud screams of alarm within her hollow limb.

Her long seige, however, was nearly over. Five days later and four months from the evening Winnie had first flown over the hill alone, mother and young emerged by knocking away the entrance wall. Hearing hornbill noises toward the lake, I went over to find Winnie and his mate snuggled side by side. His head went far back as she nibbled at feathers on his throat. Her plumage was soiled and the feathers on the top of her head were worn off, from long confinement in cramped quarters, but this made no difference to Winnie. His head went still further back in the pure enjoyment of having those inaccessible feathers on his throat nibbled and preened once more. This idyll was alloyed by only one circumstance. Clytemnestra, with no signs of giving up, was perched only a few trees away.

I could not find the young hornbill at this

Two days after leaving the nest in the Botanical Garden, "Mutesa" was attacked by another hornbill and was crippled. Its parents found it at the author's home 2 miles away.



time. On the following morning, however, a chance bird-watcher saw a female hornbill attacking it savagely. I later found it clinging to a tree near its parents in a crippled condition, and the following morning I picked it up from the ground. Its foot was broken. Knowing that it might be a victim of the next passing dog, I started carrying the young male to the car despite Winnie's swooping again and again at my head. My wife and I named our young hornbill Mutesa, and successfully bound his foot in a metal splint. Mutesa spent his first days in our outdoor zoo on the ground. Within a week he was able to leave his lowly associates, a Leopard Tortoise and a Nile Crocodile, and perch with our other three young hornbills. I went back to the Botanical Garden on the afternoon of Mutesa's capture. His parents were back by their nest tree, and as I was turning to leave I heard a flutter of wings. Looking back, I saw both birds hard in pursuit of Clytemnestra. It was the last I saw of this evil genius. Whether she was the offspring of a former year who felt rejected or just a lone female I will never know.

I thought that I had seen the last of Winnie and his mate. Mutesa was completely cured by April. Various hornbills passed through our garden, but one pair came to stay much of their time, perching in trees close to our outdoor zoo. Their cuk-cuks and wailings resounded through our house. The male would occasionally swoop down over the wire netting. Curiosity aroused, I compared his bill markings with sketches in my notebook and had no further doubt as to his identity. Winnie and his mate had found their lost young one. They had come to us from the Botanical Garden two miles away. For the next six weeks, until we left Entebbe, they spent much of each day in our garden, making an almost continual commotion.

Our young hornbills all developed full plumage. The only opening to their large cage was a livingroom window. Friendship, our Glossy Starling, was always the first to greet us in the morning. After I had sat down to breakfast, three of the hornbills, Mpanga, Zika and Mpigi, would come whooshing through the dining room to perch close to me, usually on the edge of the table. They came for bits of toast dipped in coffee. Sometimes they would drop in for other



“Zika” (at the left) and “Mpanga” in their big cage outside the author’s livingroom. In this picture they are about two months old and are still in a ragged state of developing plumage.

meals, hopping over the table to inspect all plates but not neglecting the flower centerpiece. Appetites satisfied, they would whoosh back through the living room and out to their cage. There might be a few odd droppings to clean up on the cement floor. It was wonderful to have some of the hornbills from Mpanga Forest tame and living close at hand where I could continue studies on their behavior at all hours of the day. My wife was patient most of the time. Occasionally, however, it was too much, and she would get up from the table with Friendship perching in her hair and a hornbill on each arm, and take them to their cage. The house would then become free, at least momentarily, from some of the commotion of an African jungle.



(Sketches by Author)

THE AFRICAN BUFFALOES

By LUCIEN BLANCOU

Chief Game Inspector for France Overseas

Translated from the French by Lawrence G. Blochman

IT IS RATHER DIFFICULT to treat the buffaloes of Africa as a unit, for their variations are such that certain naturalists, and not the least distinguished, have come to the belief that there are two distinct species which are, however, linked by numerous intermediates.

Personally I am convinced that there is but a single species — and other mammalogists just as distinguished as the first group agree with me — but that conditions of existence in totally different localities within the habitat have brought about considerable modifications between the two extremes. The African buffaloes, in fact, inhabit almost all of the continent south of the Sahara, from Upper Senegal to the Addo forest in the Cape Province, with the exception of the semi-desert of Kalahari and several other South African regions where lack of water has made life impossible, at least in recent times.

Over this vast expanse, three groups of forms may be distinguished: those of the forests, those of the savanna woodlands and those of the savanna grasslands — all this, it should be understood, without scientific pretension.

The Forest or Dwarf Buffaloes, which seem to be the prototype of the species, are the smallest of their kind and are found from French Guinea in the west as far as Ituri in the northeast of the Belgian Congo. Those of the Congo appear to

be the smallest. These animals measure on the average 39 to 43 inches at the withers, do not weigh more than 660 pounds, and are generally russet-colored although there are fairly numerous melanistic, or black, specimens, particularly among the males. Horns average 12 to 16 inches among bulls and are often closed crescents.

Through numerous intermediate specimens these little animals give way to the buffaloes of the more-or-less wooded savannas that stretch north and south of the Great Forest. This form of buffalo stands 4 feet 5 inches at the shoulder, weighs up to 990 pounds, is usually russet but frequently brown, and has horns measuring 24 to 30 inches.

Finally, other geographical races — the buffaloes of the Sudan and those of the Kivu volcanoes — lead by gradation to the most imposing form of all, called the Cape Buffalo, although it actually shows little variation between Kenya and the Transvaal (Kruger National Park). The Cape Buffalo averages almost 5 feet in height, although it may reach 5½ feet; weighs 1,750 pounds and more, and has horns, turning downward at the base with upswept tips, measuring 43 to 51 inches and more.

Of this majestic panorama of a species in full evolution, I am personally best acquainted with the buffaloes of the savanna woodlands.

The life of the Savanna Woodlands Buffalo is the easiest to observe. Excluding the special characteristics of the buffaloes of the Great Forest, the fairly rare herds of which live a secret existence of their own, here then is a quick glance at the life of the majority of African buffaloes.

After a gestation period of about ten months, the calf is born with a rather thick, almost curly coat, usually of a light color but varying in shade from *café au lait* to reddish-brown. The color darkens with age, becoming quite black at three years in the case of the large buffaloes of the East and South. A few specimens are nevertheless born with dark brown or blackish coats.

When about to calve, the mother leaves the herd for several days, but she is rarely seen alone with her offspring and it is certainly not prudent to approach too near on such occasions. Personally I have had the experience only once in a thickly-wooded region of the Ubangi-Shari. At any rate, the mother and calf obviously rejoin the herd without delay, for it is quite common to see young ones in a herd when they are still scarcely able to stand on their own feet.

The calving period stretches over the end of the dry season north of the Equator and over the rainy season, it would seem, to the south. In

other words, during the same time of year: from January to March.

Although without personal knowledge confirming the fact, I do not believe that buffalo cows bear before the age of three years.

The composition of the herds varies according to terrain and season. In the forest the herds are smallest and rarely include more than one family, more or less large, which separates rather early.

In the savanna, it is the progressive scarcity of pasture and watering points which determines the regrouping of the herds. Thus the larger gatherings may be noted in the most arid zones at the end of the dry season. When and where forage and water are less scarce, the groups remain more widely scattered.

The typical group is obviously that of one bull with his cow or cows. Apparently this basic unit is constituted at the beginning of the rains for females with no young. The family is later augmented by one or more calves. I have never observed twins.

Normally the competition for females brings on fights between bulls. Buffaloes, however, are so social and gregarious in character that such fights are rarely observed. I have personally seen only one or two such clashes and none of the

The various buffaloes of Africa range from the Dwarf form that weighs not more than 660 pounds up to the big Cape Buffalo — as here — that may weigh up to 1,750 pounds and stand 5½ feet high at the shoulder.





Competition for females brings on fighting between bulls; otherwise they rarely give battle.

bulls seemed fully aroused. Most of the wounds observed among the buffaloes seem to have been made by other wild animals (the signature of the lion is unmistakable) or human hunters. Marks of goring by horn are extremely rare.

The question of love battles brings up the question of the fighting solitary. The word has been greatly abused in connection with buffaloes and, incidentally with mammals in general. In fact, the typical solitary — the animal which because of age, sickness, or wounds has broken off all relations with his herd — is not very common. He does exist, of course, with horns broken or worn down, but he is no more dangerous than his fellows unless, half blind or deaf, he finds himself cornered and believes he must charge in self-defense. But many bulls believed to be solitaires (I have never personally seen a cow alone) are in that state only temporarily.

The very name of "buffalo" evokes, even for non-hunters, visions of danger, of combat, or dramatic escape. Some magazines love to print stories of this kind. The reality, however, is disappointingly less exciting. Let me sketch a few scenes from nature.

The dry season is upon the savanna. We see a herd of thirty to forty buffaloes, among them three or four adult bulls with well-developed horns, moving at dawn across a treeless prairie. They have been drinking in a pond that is drying up, and several of the animals have been wallowing in the shallow water to accumulate a protective covering of mud against the stinging insects. As the sun rises, this mud is baked into a hard

shell along the animal's back; the brush and the tall grass strip the armor from their legs little by little. Leaving their big hoof prints and the marks of their great bodies in the muddy edges of the water hole, the buffaloes move on, grazing as they go. A few white Cattle Egrets flutter about the herd. Although the flanks and lower parts of the buffaloes are infested with ticks, the egrets seem little interested. They watch for the grasshoppers and other insects aroused by the passing of the herd, snapping up their prey in full flight. The ticks are left for the Ox-peckers, dull-colored little birds with hooked beaks, parading up and down a buffalo's back as if it were a drill field, digging the insects out of the hide.

The pace of the grazing buffaloes is quite rapid, nothing like our domestic cattle more or less confined to a single meadow. So after several times around, they do not dally longer but disappear into the shade of the little wood which encircles the pond and the grassland. A few Oribi Antelopes watch them move on.

Under the trees the buffaloes disperse, still grazing. The cows are accompanied by their calves, some newly born, some already a year old. Some cows are ready to calve again. The adult males bring up in the rear, led for the moment by an old female. When the sun grows really hot, the animals stop grazing. They move through the undergrowth in single file. At about ten o'clock, two or three miles from the clearing where they had been grazing before stopping for their dawn drink, they lie down in the shade to ruminate. They lie in groups, each bull surrounded by his cows and their offspring. In a separate group are a few young bullocks and heifers, old enough to have left their mothers but too young to leave the herd.

About four o'clock in the afternoon the herd gets slowly to its feet and moves off again through the woods, once more grazing. Toward sundown it will come into another treeless clearing with another drying water hole surrounded by red laterite soil. It will then resume grazing until fairly late into the night.

But at this late hour the adults become more vigilant. A couple of Lions rove the area, hoping to carry off a young buffalo that has strayed too far from the herd. If the big cats can creep near enough without being detected and succeed in

bagging their quarry, the battle will be joined in earnest. Without hesitation, male and female buffalo alike will charge, bellowing furiously, toward the pale blurs in the underbrush. There is never any certainty whether the Lions will abandon their victim. They may retreat before the charge, hoping to come back later and retrieve their dinner, or they may try to hoist the carcass into a tree, although this is not usual.

It may happen that the Lion has been surprised and caught by the thrust of a buffalo horn. If he does not then escape, he will be trampled into a formless pulp. Such a case would be a rare exception, as the Lion usually remains master of the terrain. For although the sight of him drives buffaloes to fury, the smell of him seems to spread



Dwarf Buffaloes enjoying a siesta. During the heat of the day they are likely to seek shade.

panic through the herd. Besides, the Lion seeks out particularly the strays, the young or old. While the experienced oldsters can put up an excellent defense, the Lion is equal to any adult buffalo of the savanna woodland. Remains found in the bush bear witness to this.

The monotony of buffalo life is thus varied by little except these battles in self-defense, and they are not very frequent. Lions are far less common in the savanna woodlands than in the grasslands where there are many species of antelopes and — in East and South Africa — Zebras and Warthogs with which to vary their menu.

But the buffalo has other enemies.

First of all there are the epizootic diseases, likely to be contracted at waterholes and on pastures frequented by domesticated bovines. We then see a sad trail left by the stricken herd. It is the

young who first pay tribute to the scourge, and their mummified carcasses mark the approaches to dozens and dozens of water holes — unless the Hyenas and later the vultures have already been there. The cattle plague and other epidemics are always rife in Africa, but the vaccination of domesticated herds of cattle by government veterinary services has done much to reduce the risk of infection. As a result the buffalo leasehold has been reinforced almost everywhere, even in regions where it had been practically wiped out at the end of the last century. It is true in many places, particularly in Rhodesia, these same veterinary services have themselves been calling for the extermination of the buffalo, often successfully, in order, so they say, to help wage war against the tsetse fly.

For the buffalo's worst enemy is indeed man.

Except in completely inaccessible regions, the buffalo herds are constantly subjected to the thunder of gunfire — from the old-fashioned "slave-trade" firearms, flintlocks and percussion guns, of which there are thousands in the hands of native Africans, down to the most modern of hunting weapons, repeating carbines and express rifles of all kinds. Only nightfall brings respite to the animals. By day the buffalo may be surprised at any hour by gunfire, by pitfalls which collapse under their feet; by poisoned arrows which kill silently; by snares which entangle the legs; and by nets accompanied by flights of assegais.

It is true there are also brave men among the hunters, although they are rare. The courageous hunters will go after their prey with only a spear



Lions spread panic in a herd. They usually attack strays, or old, or very young buffaloes.

in each hand, and allow themselves to be completely surrounded by the herd before they launch their weapons successively to right and left. And there are finally the jeep hunters who, in country favorable to jeeps, such as the Gaboon, the Middle Congo and Angola, ride out after the frantic herds, blasting away hastily, pursuing them to the death.

Thus the number of buffaloes decreases in many regions and the species is becoming more and more nocturnal, unwilling to risk open country except under cover of darkness. Even today, after fifty years of efficacious protection, the large buffaloes of Kruger National Park remain among the wildest of species, afraid to show themselves in broad daylight, and with quite a different attitude toward autos than the Lions, for instance.

For the native hunter, the buffalo is a highly-prized animal. It furnishes large quantities of meat for personal consumption or for the market, either fresh or smoke-dried. The hide makes excellent sandals and the tail is widely used as a fly whisk. Fortunately, market hunting is carried on only locally. Otherwise, with the inevitable increase in the number of firearms, the buffalo would be soon exterminated.

The domestication of the buffalo has never been tried systematically. There have been a few isolated cases of young animals being raised by both white and black farmers, who report no difficulty. It must be admitted, however, that the capricious and high-mettled character of the species is not encouraging. It evidently seems to be simpler to get rid of the buffaloes in exterminating the tsetse fly and to replace them with domesticated cattle which are more docile because they have been serving man for thousands of years.

In some regions, however, the elimination of the tsetse is so difficult and troublesome that the buffalo may still survive there for a long time.

In any case the species exists in most of the natural reserves of Africa. Accordingly as these are multiplied and effectively protected, the buffaloes have many a long day to live, for the species is vigorous and in full vitality.

It is impossible to give an exact figure for the population of buffaloes in Africa, but to make a rough approximation we might say they are at present about ten times more numerous than the

elephants. I agree with my very good friend Dr. R. Malbrant when, in his book *Le Grand Livre de la Faune et de la Chasse en Afrique* (1954), he estimated the buffalo population at three to four million.

In conclusion, if we may leave the province of natural history for that of the hunt, we may consider the question of the danger of the buffalo to the human species. This is a subject frequently dramatized, and yet in all frankness I believe that I can affirm that normally the African buffalo presents no danger whatever to any man.

The only time, under natural conditions, when these animals may become vicious and attack without provocation is when they are suffering from some epizootic disease. There are times when the stricken buffalo, driven mad by the malady but still in possession of most of his powers, may enter a village or a farm and attack the first man in sight. I remember particularly a case in Ubangi-Shari about thirty years ago when a bull buffalo killed a man and then killed the man's brother, the village chief, who ran to his aid. This, however, was exceptional. Most sick buffaloes crawl off to hide in the bush and die in silence.

A buffalo who has been wounded by a Lion or another buffalo may also attack blindly if he is approached too closely while still bleeding.

But it is the hunt and hunting wounds which are responsible for almost all accidents. Personally I have never seen a charge by a buffalo, cleanly shot with a carbine, who could still run away. It is during the pursuit that the real peril begins. The longer the pursuit and the denser the undergrowth, the greater the danger. The buffalo will then attack to get rid of his tormentors. Whether or not he will deliberately lie in ambush for the hunter is too controversial a question to be dealt with here. I have seen very few violent reactions on the part of buffaloes, and even fewer which would lead me to suspect a true ambush.

But it is unquestionably true that an attacking buffalo will charge with all his might and main and cannot be stopped except by a veritable hail of bullets. It is wise for the hunter to avoid such a situation by using a firearm appropriate to his game, by firing from as close range as possible (but not *too* close), by aiming for a vulnerable

spot, and finally in case of pursuit — and sooner or later this is bound to happen — by taking every precaution against surprise.

The most dangerous buffalo of all is one wounded by a clumsy, inexperienced huntsman who stubbornly pursues his quarry with inadequate arms — with a badly-loaded percussion gun, for example, or with an ordinary hunting rifle that fires rounded bullets, or, worse yet, buck shot. The sorriest part of cases like this is that it is often the innocent bystander who gets disem-boweled — perhaps a woman on her way to draw

water — while the guilty huntsman is far away. This type of accident has become more and more common in the Gaboon in recent years.

To sum up, we may say that the buffaloes of Africa, black or red-brown, have been grossly slandered (“four-legged demons,” they have been called), and that they are not nearly as black as they have been too often painted, apparently for no other reason than to send delicious shivers down the spine of some reader peacefully turning his pages somewhere far from the tropics, far from the equator.

News from the Conservation Foundation

Walford Marine Study

The long-awaited book on marine resources by Dr. Lionel Walford has finally come off the presses. Entitled “Living Resources of the Sea: Opportunities for Research and Expansion,” this handsome volume is enriched by 23 original maps showing the areas of ignorance as well as of knowledge about life in the sea. The book may be obtained from the Ronald Press, 15 East 26th Street, New York 10, the firm which has published a series of Conservation Foundation studies.

Book Planned on Pesticides

A book on the relationship of animal control to the biotic environment, with chemical agents prominently treated, will be sponsored by the Foundation and the Zoological Society beginning June, 1958. The author will be Dr. Robert L. Rudd, a zoologist at the University of California, who is co-author of a widely known report, *Pesticides: Their Use and Toxicity in Relation to Wildlife*. Dr. Rudd will travel extensively in this country and Canada in the course of discussions with the many experts whose special fields he will be surveying. The text will take about 18 months to complete.

The theme of the work is that chemicals are the latest and most formidable in a whole series of measures that have been used for crop protection and pest control. Use of chemical controls

is increasing yearly, and now far exceeds the pace of growth in knowledge of their side-effects on wildlife and the whole living environment. We are only now, very belatedly, acquiring knowledge of these effects. Under the guise of animal and crop protection man is able to limit or destroy the very values for which he initiates protective measures. The text will attempt to suggest how profits and losses in chemical controls should be evaluated. Parallels will be drawn with similar dilemmas in conventional predator control programs, and the pressures — economic and other — and make for increasing and excessive reliance on pesticides will be treated.

Television

The television program “Survival” recently seen over Channel 4 in New York and conducted by Albert Burke of our organization, has received an unusually enthusiastic public response, according to the National Broadcasting Company. As of mid-March, more than 1,450 letters and cards were received from all over the country, most of them requesting copies of the scripts. The program, which concluded in New York in February, is still being seen in Washington, D. C., Buffalo, N. Y., and Bakersfield, California. Re-broadcasts of the series are being carried over the educational TV network from Ann Arbor, in Chicago, Boston, Buffalo, Philadelphia and Los Angeles.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

“Extinct and Vanishing Birds of the World”

The long-awaited “Extinct and Vanishing Birds of the World” by James C. Greenway, Jr., of the Museum of Comparative Zoology at Cambridge, has just been published by the American Committee for International Wild Life Protection.

This 517-page book does for birds what two earlier American Committee publications did for the mammals of the Western Hemisphere and the Old World—focuses attention coolly and dispassionately on the species and subspecies that man or circumstances have exterminated or now threaten. It is not an emotional plea for conservation; it is *the* source book of ascertainable facts to which conservationists will turn for many a year to come.

Since sailors, pigs, monkeys, cats and rats ate the last Dodos some 270 years ago, 44 species and 43 subspecies of birds have been exterminated. Twelve more species and seven subspecies are probably extinct, and 77 forms (mostly island populations) are so few in numbers and so threatened that they are thought to be in danger of extinction.

The geography of extinction (the subject of a long chapter) is especially interesting. Dealing only with the extinct birds and lumping species and subspecies, the record shows this range of disappearance:

	<i>Extinct</i>
North Atlantic Islands	1
North America	5
Guadalupe Island (off Mexico)	5
West Indies	12
South Atlantic Islands	1
Hawaiian Islands	16
Galapagos Islands	1
Central and Western Pacific	24
Australia	3
New Zealand	2
New Zealand (outlying islands)	7
Asiatic Islands	2
Asia	1
Islands of Indian Ocean	7

In a typical section devoted to a bird, Mr.

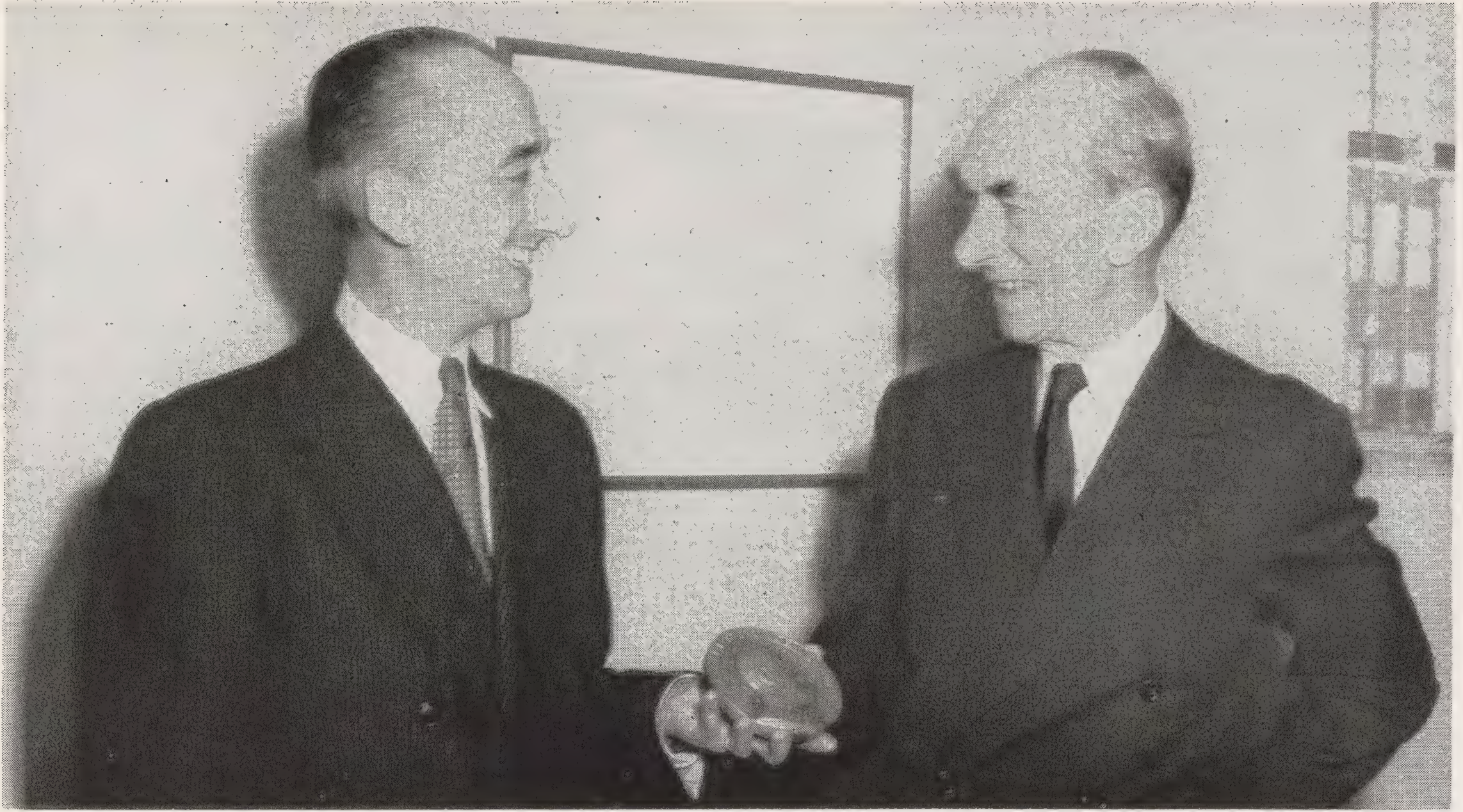
Greenway gives its scientific name, reference to its original scientific description, its common name, status (extinct, probably extinct, etc.), range, habitat, habits, description (often with an excellent drawing by David M. Reid-Henry) and, in the case of extinct birds, the museums in which remains are to be found. With the exception of the Dodo, all the 87 definitely extinct birds “are known by their representative types in museums, and their histories are well documented.” In addition to the extinct and probably extinct forms, Mr. Greenway discusses birds known only from recent osseous remains, and even hypothetical birds known only from old illustrations and the more or less imaginative descriptions of travelers in distant times. The book is documented by just short of 700 references.

“Extinct and Vanishing Birds of the World” may be ordered from the American Committee for International Wild Life Protection, the Zoological Park, New York 60, N. Y. The price is \$5.00, and the edition is limited.

Artists Who Worked in Zoo Hold an Exhibition

Paintings, graphics and sculpture by 21 artists, all but one of whom worked in the Bronx Zoo, are on exhibition at the Burr Galleries at 115 West 55th Street from March 30 through April 12. The lone exception is Rosa Bonheur. Among the others are Lloyd Sandford, the Zoo’s staff artist, and Joseph Bell, Head Keeper of Birds.

In a foreword to the exhibition catalog, Director Tee-Van remarked that “one of the earliest photographs in our collection dating from the first decade of the century shows a bearded artist at work in the Zoological Park. . . . That artists still come to the Zoological Park to capture the grace and beauty of animal forms and colors is evident from this exhibition. We are glad to have them come to us, for they share with us the desire to interpret the world of animals to the world of people.”



At a ceremony in the offices of the Zoological Society on January 31, Commandant Jacques-Yves Cousteau (left), underwater explorer and Director of the Oceanographic Institute in Monaco, presented the gold medal of the Institute to Dr. Fairfield Osborn of the Zoological Society.

Dr. Osborn Receives Gold Medal of Institut Océanographique

Dr. Fairfield Osborn was awarded the gold medal of the Institut Océanographique of Monaco on January 31 at a ceremony in the offices of the Zoological Society. The presentation was made by Commandant Jacques-Yves Cousteau, the underwater explorer and Director of the Institute. The citation accompanying the medal said in part:

Dr. Osborn has been the guiding spirit of numerous organizations whose purpose it is to protect the natural environment we have inherited. . . . For a number of years Dr. Osborn has realized that his task is not limited to the protection of the terrestrial fauna. Passionately interested in oceanography, he has shown the keenest interest in man's increased exploration of the seas. . . .

Dr. Osborn also understands that the methods of intensive exploitation of the sea by marine fisheries are at least as serious a threat to the marine environment as are hunting and industry to the wild animal species on land. He has therefore assumed the task of encouraging . . . throughout the world a series of underwater preserves, better described as "underwater national parks." With his help, we should like to establish the first of these parks in Monaco.

As a deep-sea diver, I can testify to the ravages caused throughout the world by dynamiting, underwater fishing, and trawling. There is barely time to listen to Dr. Osborn's warnings and to acknowledge our gratitude to this guide of our conscience.

The relationships of the New York Zoological Society and the Institut Océanographique extend back many years. H.S.H. Albert, the late Prince of Monaco, was elected an Honorary Member of the Zoological Society more than forty years ago.

IN BRIEF

Elk Antlers Off—Late

It seems useless to try to predict the date when our big American Elk will shed his antlers. There was for some time a tendency to shed earlier each year — April 18 in 1947 and March 17 in 1956 indicated the trend — but last year the date was March 19, and this year it was March 24. The Mammal Department has given up guessing.

In-Service Teachers' Course

Teachers in the high schools and elementary grades of the city have swamped our facilities for the 17th semi-annual In-Service Teachers' Course that began in February. We are able to accept 112 registrants and 40 were refused for lack of room.

Aquarium Admissions

While admission rates to the Aquarium remain the same as last year — 90 cents for adults and 45 cents for children — the age limit for children has been raised from 12 to 16 years. Additionally, organized groups of children, such as Brownies and Boy Scouts, will be admitted at 25 cents each and 25 cents for each accompanying adult if they have previously communicated with the Aquarium. School groups are admitted free by appointment.

Adelies on Exhibition. Two Adelie Penguins, the first we have exhibited, have been found to be

apparently free from aspergillosis and have been placed on exhibition in the Penguin House. We now have fifteen specimens of seven species in that air-conditioned unit.

New Admission Fee. From the opening of the Zoo in 1899 until May of 1941, the admission fee on certain days each week was 25 cents. From the spring of 1941 until March 4 of this year it was 10 cents. Now we have returned to the 25¢ fee, except to Members of the Zoological Society, on Tuesday, Wednesday and Thursday. Proceeds of gate charges may be used only for improvement and repair of the Zoological Park.

New Members of the New York Zoological Society

(Between January 1 and February 28, 1958)

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SPRING MEMBERS' TOURS

AT ZOO AND AQUARIUM

Of all the months in the year, April and May are probably the best for Zoo- and Aquarium-going. Elephants and Lions take a long stretch in the sun, Walruses wrinkle whiskers, Nyalas and Zebras frisk about, some of the most solemn birds get frivolous nest-building ideas, Peacocks display, and even the Giant Tortoises seem to feel glamorous.

To celebrate Springtime, we have scheduled three Curator-conducted Members' Tours in the Zoo and the Aquarium.

Saturday, April 19, New York Aquarium, Coney Island, at 10:30. It's hard to realize that the new Aquarium wasn't even open at this time last year and that Olaf the Walrus was just a pup then. Members will be conducted through the Aquarium by James Atz and Carleton Ray on a leisurely, informative tour and there's some talk of awarding a prize to the Member who can successfully spot the Ghost Moray Eel.

Saturday, May 3, Birds of Prey and Waterbirds. Curator of Birds William Conway is justifiably proud of the best collection of birds of prey we've ever had, and of our 70-some-odd species of waterfowl on Zoo lakes and ponds. You'll see some birds that will surprise you by their rarity and beauty.

All Members' Tours start promptly at 10:30 A.M., usually end at about 12. Tractor trains are available when distances are too far for easy walking. In the Zoo, movies are shown in the Members' Room. Members are requested to bring no more than two guests. No advance notification of your plans to attend is necessary.

Saturday, May 17, Bronx Zoo Mammals. Starting promptly at 10:30 from the Members' Room in the Administration Building, Associate Curator of Mammals John L. George will take you to see the Nyalas on the African Plains, the supple-necked Gerenuk, the Lesser Kudu and the pair of Okapis in the Antelope House, the up-and-coming Yak family and this Spring's crop of fawns. And perhaps the Duck-billed Platypuses will be here by then.



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VOL. LXI • No. 3

MAY-JUNE, 1958

ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

The World at the Zoo

SOMETIMES AN EPISODE, perhaps of no great importance in itself, assumes a vivid significance.

The other day our Zoological Park had the privilege of playing host to representatives of the United Nations — ambassadors, ministers, councilors, chargés d'affaires — some seventy men and women in all. They came from countries far distant one from another: from Indonesia, from South America, from the Sudan, from Europe, from Iraq, Liberia, Jordan, the Philippines, Nepal and Yemen. Their present tasks center in a tall edifice in mid-Manhattan where each day they play a part, large or small, in endeavoring to resolve the conflicts and problems of the modern world.

There was magic in the day which cast its spell over everyone. For once, one felt that the problems of mankind had flown away into the bright May air. It seemed that conflicts between countries must indeed be imaginary, for on this day there was complete mutuality in the enjoyment of observing animals and contemplating the wonders of nature. For a while at least it was impossible that there could be friction between man and man.

Fairfield Osborn

Olaf:

1,000 Pounds of Walrus Charm

By CHRISTOPHER W. COATES

&

JAMES W. ATZ

AMONG THE HUNDREDS OF THOUSANDS of animals exhibited by the New York Aquarium in the course of more than sixty years of operation, a few stand out as all-time favorites — animal personalities so striking that they have gone down in history, so to speak. Patsy, the male California Sea Lion that lived for 19 years in the old building at the Battery, was one of them, and the 350-pound Giant Grouper that for years dominated one of the great indoor tanks was another. Making predictions of any sort is risky, but we believe we now have on exhibition one of those rare animals so outstanding and engaging that it is destined to become part of the tradition of our institution.

This is Olaf, our young Atlantic Walrus (*Odobenus rosmarus*) whose goodnatured charm and drollery have endeared him to public and press, tankman and curator alike. Experiences in various zoos, including our own, have shown that young walruses are practically always easy to get along with in captivity, but we find it hard to believe that they all could be as appealing as Olaf. From the day he arrived at the Aquarium in Coney Island he has been the center of attraction to an ever-widening circle of visitors, reporters, photographers and scientists eager to learn about a species so rarely seen alive outside its natural habitat.

Olaf is the only walrus in captivity in the New World, and, as far as we can determine, there are only three or four in European zoos: males in Hamburg, Munich and Moscow and perhaps a female in Copenhagen. Although he is consid-

erably younger than any of these, Olaf seems to be the largest.

For us Olaf will always bear another distinction: in a sense, he was the first specimen we obtained for the new Aquarium building. When he and his mate-to-be, Karen, arrived on October 9, 1956, workmen were still busy with the unfinished building and grounds. A temporary home for the newcomers was found in one of the unfenced garden pools. Here they lived contentedly for two or three weeks during which time we believed we had gotten to know them and their requirements pretty well. There were, however, some surprises in store for us.

During this period, the garden pool was supplied with running fresh water, since the pipeline which was to carry its sea water had yet to be installed. This did not worry us, however, because we knew that walruses, like seals and sea lions, had been kept for years in enclosures provided only with fresh water — even though in nature they may spend much of their time at sea. Nevertheless, when the salt water line was completed, we lost no time making the pool a sea water one. It was then that Olaf and Karen left the pool and began to explore their surroundings. Since the whole area was bounded by a heavy chain wire fence and there was nothing harmful that the young wanderers could get into, we allowed them to go where they pleased. In our experience, all captive marine mammals like to take a look at their surroundings and, after a few unhampered exploratory trips, finally settle down in peace. Not so our two walrus babies. They

Popping up from the depths of his pool, Olaf looks at his audience and then sinks quietly out of sight to continue his exploration. If any underwater fixture can be worked loose, Olaf is sure to know





eventually settled down, but in another pool located at the other end of the area. This penguin pool-to-be was not quite finished and it, too, lacked its supply of sea water. We allowed the walruses to stay in the place of their choice — one temporary home was as good as another — but it was not long before the pipe that was to carry sea water for the penguins was put in, and once again the two walruses began to roam. This time they made a nuisance of themselves, getting in the way of the carpenters, plumbers, electricians and others who were hard at work in all parts of the building and grounds. At this point we decided, for the sake of their own safety as well as the maintenance of our construction schedules, that Olaf and Karen should be placed in the large Oceanic Tank which was to be their permanent home, even though it was still several steps from being completed. After the seawater pumping system had been arranged so that the deep tank would fill just enough for easy swimming, the animals were introduced to their new quarters.

In a few days we noticed that the appetite of both Olaf and Karen was falling off, but we put

This still unfinished pool in the lawn of the Aquarium was filled with fresh water when the two baby walruses arrived in 1956. Unknown to us, they preferred fresh instead of salt water.

this down to their reaction to being confined. They ate less and less, and we could not imagine what was the matter. All of the foods they had so avidly eaten now interested them not at all. One day as we worriedly watched them, a few drops of rain started to drip into the pool from some new construction on the roof, and while we watched, both walruses pushed and jostled each other to catch the drops in their mouths. It was obvious that fresh water was what they wanted. When a garden hose of flowing tap water was lowered into the tank, the two youngsters gulped and gulped as if they would never stop. From then on we saw to it that our walruses were never without a supply of fresh water.

Although Olaf continued to take drinks of fresh water for several months, none of the other marine mammals that shared the Oceanic Tank with him ever availed themselves of the small

flow of tap water we had piped into it. Young walrus may be unique among the seals and sea lions in their need for fresh water, although we have seen baby Gray and Harp Seals eat ice with apparent relish.

That young walrus need fresh water is only one of the things Olaf has taught us. By watching him swim from both above and below the water surface — as is possible in our Oceanic Tank — we have learned a good deal about walrus locomotion. Zoologists consider the two species of walrus to be more closely related to the seals than to the sea lions and fur seals, and the way that they swim confirms this relationship. Sea lions use their large, powerful foreflippers to propel themselves through the water, their hind flippers acting only as rudders. Seals, on the other hand, use the rear part of their bodies, together with the hind flippers, as the principal means of locomotion. The flippers are held vertically and swung back and forth in a manner reminiscent of the tail of a fish. Walrus, too, depend on their hind flippers to push them through the water, but instead of moving them from side to side more or less together as do the seals, each flipper is moved alternately and the motion includes a feathering-like rotary component that undoubtedly adds to its efficiency. The front flippers are used in stopping, turning, rotating and especially diving. Walrus appear to use them more effectively than do seals, but this may be an illusion caused by the much greater size of the walrus. Seals and walrus both also spend a surprisingly large part of their time in the water swimming on their backs.

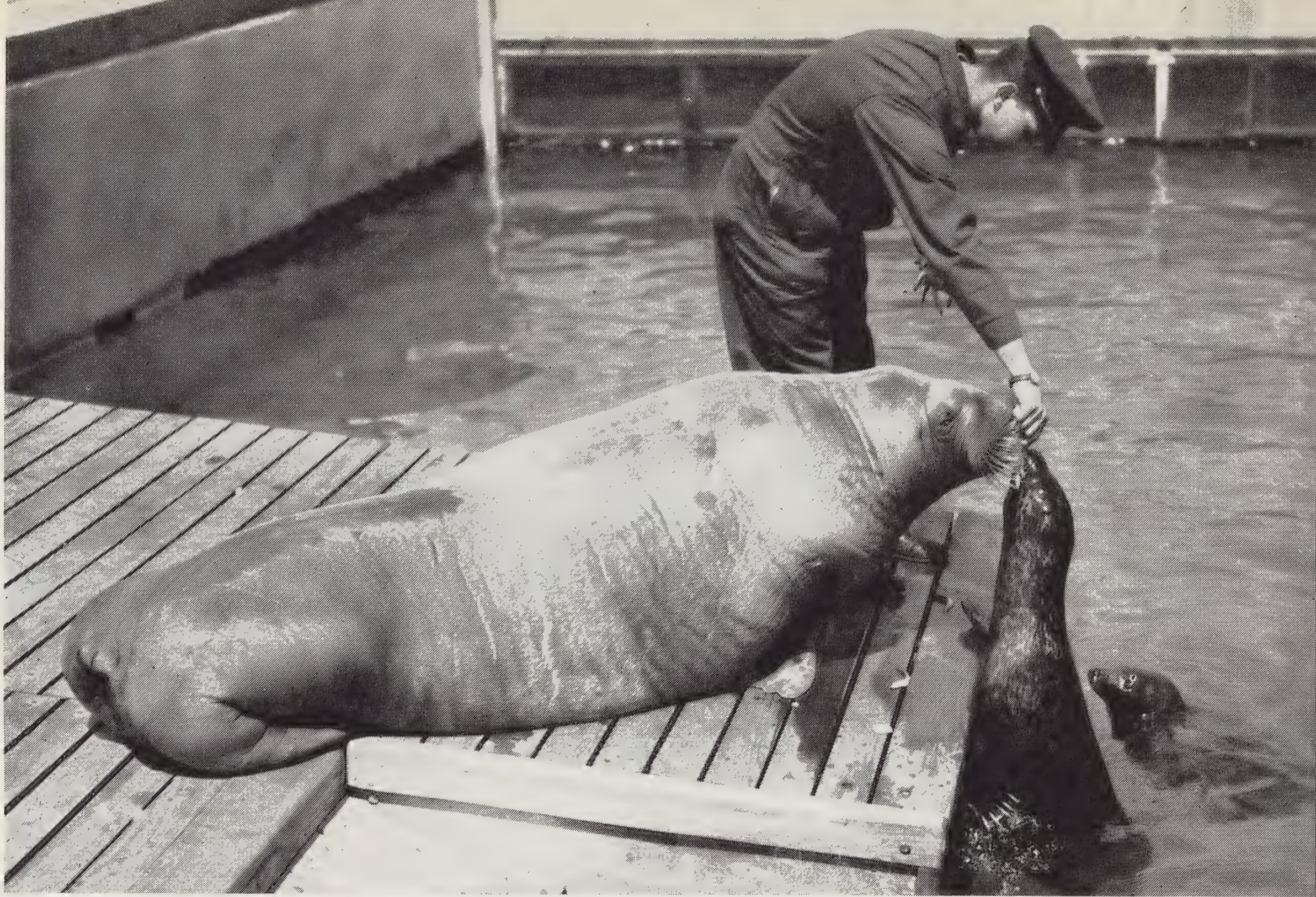
We recently got out our stopwatch and timed Olaf as he cruised about the Oceanic Tank. It regularly took him 15 seconds to swim from one corner to another, a distance of 70 feet. This figures out to be about three miles per hour, and judging from the ease with which Olaf maintains this speed, we are convinced he could do so indefinitely. His seeming effortlessness, despite his enormous bulk, can only be appreciated by seeing his blimp-like body sail majestically by. You could almost call him graceful.

By no stretch of the imagination, however, could Olaf's movements on land be considered graceful. When out of the water, he gets about by what can best be described as a combination

of a caterpillar's crawl and an old man's shuffle. In this, too, he is seal-like, although he gets more help from his front flippers than do the smaller seals.

In defence of the slow progress that Olaf makes overland, it should be pointed out that he is no lightweight. At the present time he is nearly seven feet long, not including his hind flippers which add another twenty inches to his length. His greatest girth, which is at the shoulder, measures six and one-half feet, and this tapers down to fifty inches just in front of the hind flippers. We estimate his weight to be about one thousand pounds. When he arrived, twenty months ago, Olaf weighed 240 pounds, so that he has gained weight at a rate of approximately 38 pounds per month, a little better than a pound a day! Full grown male Atlantic Walrus weigh between two and three thousand pounds and may reach 15 feet in length. Presumably this tremendous size is attained by the time the animals become sexually mature, that is, at seven years of age. It is easy to see that Olaf, who is at the most no more than 26 months old and possibly was born just two years ago, is still a "growing boy," and that although his rate of increase will undoubtedly slow down, he has a good deal of growing to do before his growth curve levels off. Female walrus do not become as large as males, but we can only speculate how long Karen would have maintained the advantage of 110 pounds that she enjoyed over Olaf at the time of their arrival. Karen's sudden death in January of last year put a temporary end to our dreams of a breeding pair of walrus; however, we have plans afoot that may yet give us that unique distinction.

Size alone makes Olaf stand out from the crowd, but it is the wonderful combination of bulk and friendliness that gives him his special appeal. To see an animal his size nuzzle his keeper like a puppy or play with a ball in the water for all the world like a child is a delightful incongruity hard to equal anywhere. When workmen have to enter the Oceanic Tank for painting or repairs, Olaf is always something to be contended with, since his curiosity is boundless and he seems afraid of nothing. That is, nothing except elephant seals. Shortly before opening day last year, we added two Northern Elephant Seals, an adult cow and an adolescent



male, to our Oceanic Tank. Although somewhat cantankerous in disposition, the two did not seem openly aggressive. Yet their effect on Olaf was blighting, to say the least. He barely went near the water, remaining immobile on the raft, and in other ways showed his mortal fear of the newcomers. There was nothing to do but remove the two elephant seals. Later in the year we introduced an even smaller male of the same species into the Oceanic Tank with the same result. We should mention, however, that Olaf gets along splendidly with the Harbor Seals and California Sea Lions that have shared his tank since last June.

Not much is known about the life history of walruses. For instance, some authorities claim that the female gives birth to her calf or pup in the water, although, with one possible exception, all species of seals and sea lions have their pups on land. Recent studies by A. W. Mansfield and his associates of the Fisheries Research Board of Canada are beginning to fill in some of the gaps in our knowledge of the Atlantic species. The young are born in April, May or June. Since the period of gestation lasts a year, we may presume that mating also takes place in the spring. Females nurse their single calf for 18 months to two years — a longer period, it is asserted, than in

Olaf gets along amiably with the Harbor Seals and California Sea Lions that share his big tank, but he was obviously intimidated by the Elephant Seals previously exhibited there. They had to be removed

any other mammal. Females therefore cannot have young more than every other year, but the average breeding frequency is actually one calf every three years. Olaf and Karen were born near the coast of Greenland in the spring of 1956 and, of course, were still nursing babies when captured.

Undoubtedly the principal obstacle to the successful maintenance of walruses in captivity has been the lack of proper food, especially for the young. Not until a satisfactory substitute for walrus milk was worked out did any zoo or aquarium keep walruses for satisfactory lengths of time. (The record for longevity in captivity is now 12 years, held by a female that lived in the Copenhagen zoo from 1937 to 1949). To the best of our knowledge no one has ever completely analyzed walrus's milk, although we received the information that it contains 45% butterfat indirectly from the captors of Olaf and Karen. Without doubt, walrus's milk is very similar to seal's milk, whose composition is well understood. Seal's milk differs from cow's milk, as well as that

of most other terrestrial mammals, in its extremely high fat content and its very low sugar content. To simulate this, ordinary canned evaporated milk is fortified with vegetable oil (roughly one part in twelve) and cod liver oil (roughly one part in forty-eight). To this is usually added raw fish, either cut-up or shredded. We have modified this formula by adding both fish and clams, with more of the latter than the former. We have also provided a generous vitamin B₁ supplement to counteract the known anti-vitamin activity of some of these foods. Now that Olaf has reached weaning age, we have gradually cut down on the amount of milk in his diet. He now subsists almost entirely on clams of the large, hard-shelled species, *Spisula* (*Macra*) *solidissima*, and on fish, principally smelt, mackerel and butter fish.

It is generally agreed that in nature walruses live principally on shellfish such as mussels and clams. It is also generally agreed that they use their tusks to dig these burrowing bivalves out of the sand or mud. But one look at Olaf's tusks, which are only an inch and a half long, shows that they could not be of much use in procuring food. Immature walruses like Olaf and adult females in which the tusks are sometimes lacking, obviously must be able to feed themselves without the benefit of a built-in clam rake. (In a full-grown male, these two modified upper teeth may be 24 inches long, and they can be used with devastating effectiveness as defensive or offensive weapons).

There is, however, no agreement as to how walruses handle their shellfish after they get them. The questions are: how do they get the animals out of their shells, and what do they do with the empty

valves? Some biologists maintain that the shellfish are either swallowed whole and digested shell and all, or that they are crushed by the teeth and then swallowed. The shells may then be either regurgitated or digested by strong acid in the stomach. On the other hand, it has been reported that walruses with shells in their stomachs are seldom found, and this most likely indicates that shell and flesh are separated before the animal is swallowed. How this is accomplished, however, is a mystery. Since we have always fed our walruses on shucked clams, we can add nothing toward the solution of this problem.

We have observed, however, that walruses handle their whiskers with considerable manipulative skill. These tremendously thickened bristles must be more than mere hirsute adornment. We believe they play an important role in obtaining food under natural conditions. When given a fair-sized fish, Olaf holds it to the ground with his whiskers while he sucks off the flesh. If the

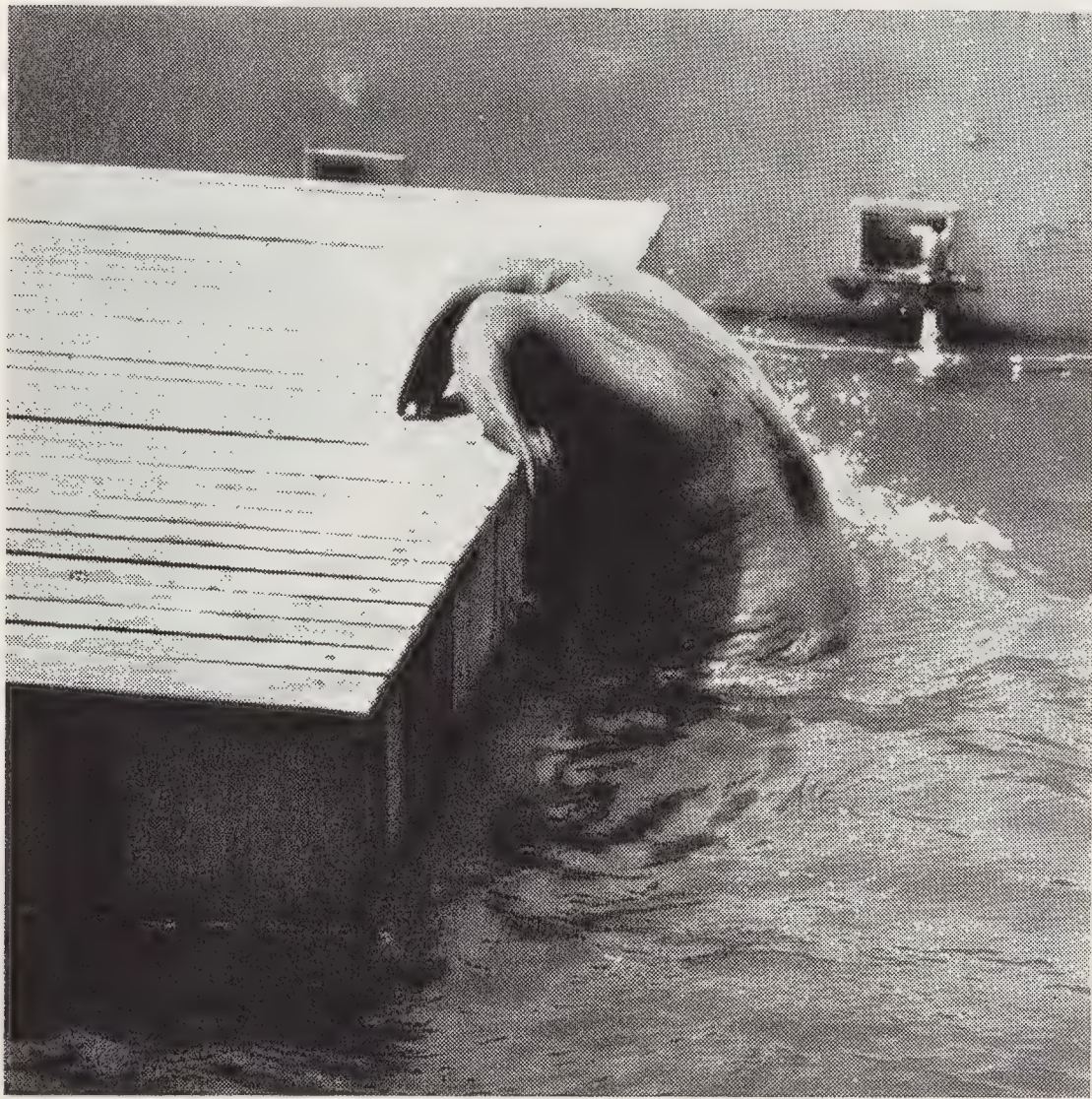


Olaf's tusks are only about 1 1/2 inches long and are best seen as he is being fed. Here Tankman DiLauro offers a clam. Olaf is now two years old and is being weaned to an all-solid diet.

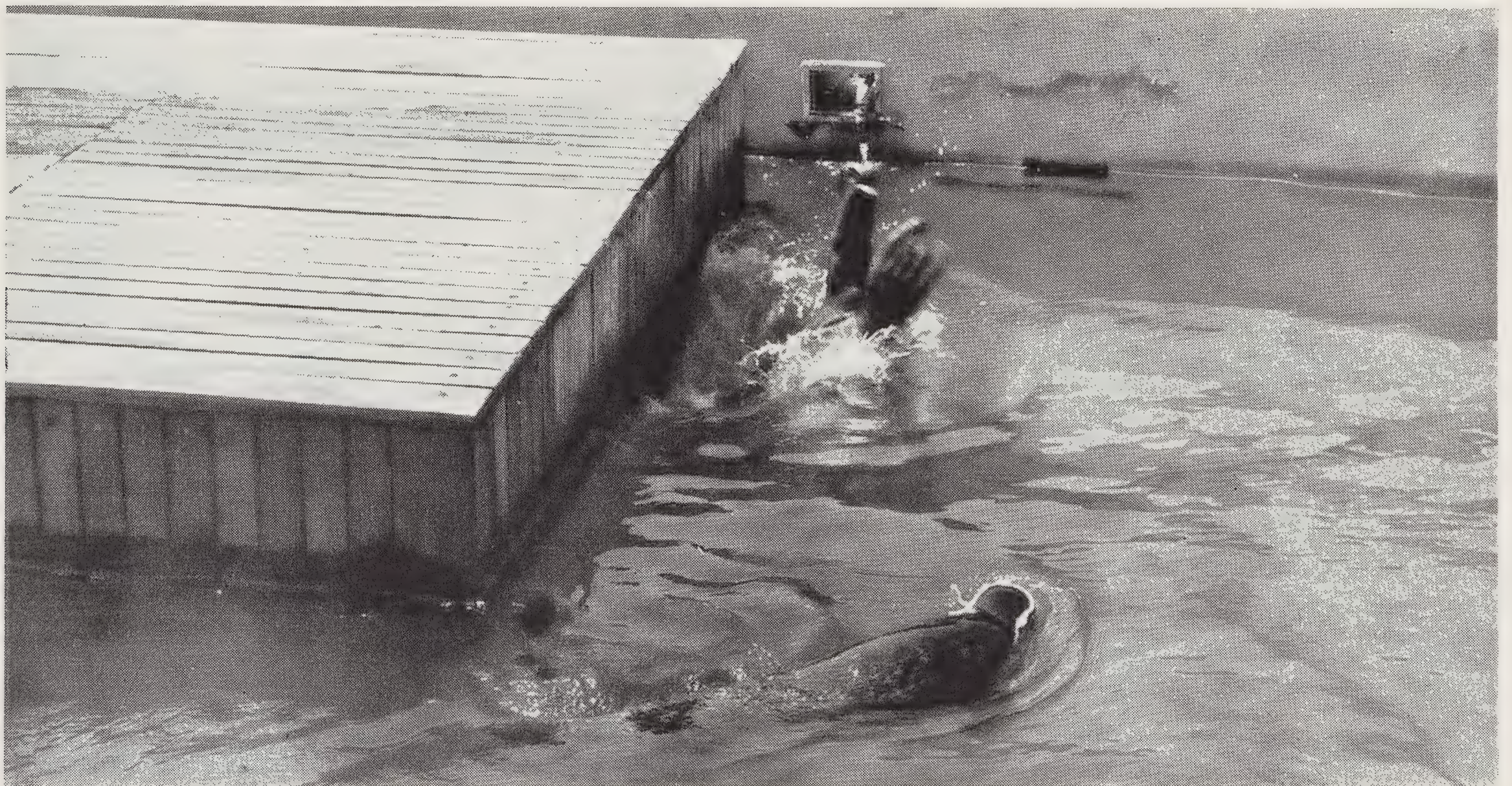
backbone is sturdy enough, a neatly skeletonized fish results. Olaf can also hold a shucked clam in the air with his whiskers before commencing to suck it into his mouth. We should point out that the peculiar arrangement of teeth in the walrus makes it impossible for the animal to use them in holding or biting food, although presumably it can crush or chew to some extent with its molars.

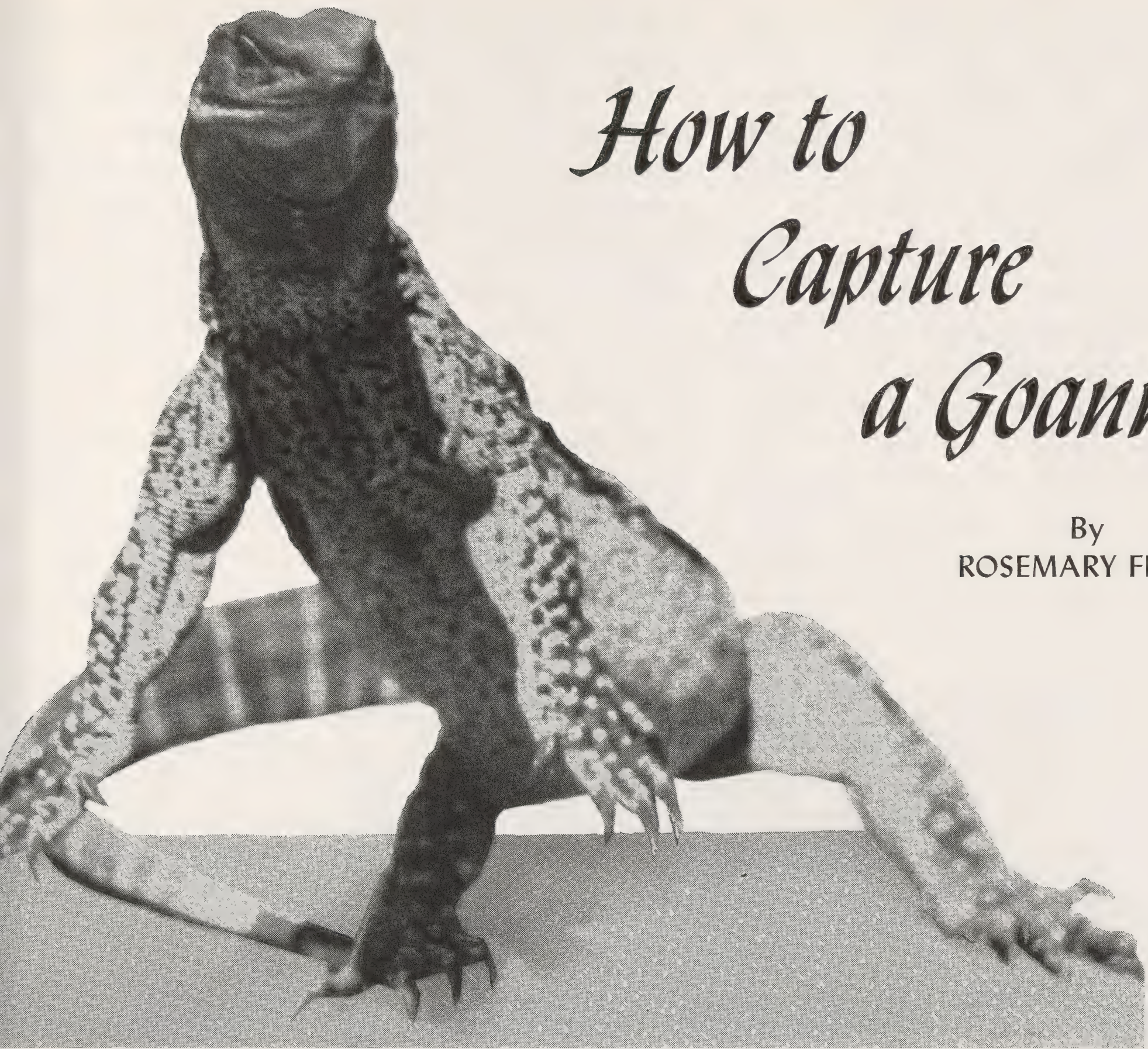
When an animal eats as regularly and as well as Olaf, any change in its feeding habits is immediately noticed. On the evening of Labor Day last year, Olaf refused to eat his supper. Thus

began a self-imposed fast that lasted more than a week. With the exception of a clam or two, he did not eat for the entire period. Nor would he come out of the water except on three or four occasions. Instead he unceasingly swam back and forth the length of the Oceanic Tank, seemingly oblivious of the tankmen who care for him, the visitors and the other animals in the enclosure. We estimate that he swam at least 500 miles during this time — on an empty stomach! Although no clear-cut migrations have ever been described for the Atlantic Walrus, we shall be watching to see if Olaf repeats this performance.



Olaf's keeper can usually summon him up on the float in the Oceanic Pool but when Olaf wants to go back into the water there is no stopping him. For his bulk, he goes overboard in a surprisingly unsplashing fashion.





How to Capture a Goanna

By
ROSEMARY FLEAY

THE FLEAY FAMILY is notorious for collecting mammals, birds and reptiles while supposedly holidaying. It started a long time ago; when my father was a boy, he once spent his school vacation at an uncle's farm. Upon his return home my grandmother was shocked to find that his suitcase contained several lizards and a quantity of earth in which sundry tortoise eggs were hatching. His once neatly-pressed clothes followed by rail, crammed into a sack!

During the early spring of 1956 I spent an exciting vacation on Mr. and Mrs. Peter Bell's sheep property, "Dandaraga," in central Queensland. Before I left for "Dandaraga" my father jokingly told me not to return without a large Goanna for his collection. I didn't give it any serious thought, never having handled reptiles before — furred animals being more in my line.

What a surprise was in store for me!

The vast plains of central Queensland are covered by Mitchell grass and stunted growth

When a Goanna rears up like this, it means he is in a fighting mood and ready to take on all comers. A five-foot specimen, such as the one the author caught, can give a really bad bite.

Photograph by David Fleay

known as Gidgee scrub, ideal habitat for the huge Red Kangaroos, Emus, reptiles and other wild life which abounds there. I made a casual enquiry and was told that several large Goannas had been sighted in the surrounding country that spring.

One warm morning when the men folk were away, Margaret Bell and I set out to muster a flock of some 700 sheep. I took the "tail" while Margaret and her dog kept the shoulder of the mob together. Things were going well and we were nearing home when my horse shied violently. I suddenly spotted the cause of the disturbance several yards away. It was a very large yellow and brown Sand Goanna. He was so busy digging at the base of a log above the entrance to a large burrow that he was not aware of my presence. I managed to calm the horse and,

without giving the sheep another thought, started wondering what to do about the Goanna. Here was my great chance! The reptile was more than five feet long, and broad and thick, and would certainly be a wonderful show in our Fauna Reserve.

My father's principle is action, when tackling an animal, so I didn't hesitate further but dismounted and with some trepidation made a rush at the Goanna. It was much faster than I was and after rolling out a great forked tongue toward me it shot into the burrow out of sight. I was grateful, really, for the only thing I had thought of doing was to grab its tail, and I would probably have been bitten had I managed to do that. It seemed common sense to plug the entrance to

pullover over its eyes. We agreed to return to the spot as soon as we had yarded the sheep.

The return trip was made in the jeep, armed with crowbars, shovel, stout bags and rope, and it was a relief to find everything just as I had left it. We unplugged the hole and set about digging, hoping the reptile wouldn't come forth with a rush. Eventually, after some strenuous digging, our excitement mounted as muscular hind legs with their long sharp nails came into view. What a whopper he was!

We bound rope about his hind quarters to hold him should he suddenly back out and take off at a gallop. We didn't really have much idea what to do when we had him free of the burrow, but the best plan seemed to be for me to grip him



the hole with something. My pullover and several rocks were the only objects handy, but they would serve until I could find the departed Margaret and come back to dig him out.

Back on the horse I managed to round up the last straggling sheep. Margaret was waiting for me when I arrived home feeling guilty about my poor shepherding. However, she became quite excited when I told her about the Goanna, which I hoped was still plugged in its den and not scurrying blindly about the Gidgee scrub with my

by the tail and behind the head while Margaret held the bag open ready for his reception. Grasping the thick, scaly tail we pulled with all our might but he didn't budge an inch. So we dug still further. It finally appeared that his head and front legs were wedged firmly over a root. When, covered with perspiration and dirt, we finally removed the root we had to push our weight on the broad and muscular body and stand ready to secure a firm grip behind the head.

I managed to get a tight hold on the neck and

the tail and held on grimly. I had seen my father do this, and also had heard about the huge gash inflicted on the back of his hand by a large Tree Goanna. But it was too late to worry about that now, for it was all I could do to hold on when we dragged our Goanna free of the burrow. He twisted his body, blew out his throat and uttered bellowing hisses, with his huge jaws gaping widely and showing an imposing array of jagged teeth. After a great struggle we managed to push him head-first into the sack, and then gave him an extra shove and let go his neck at the same time. It was certainly a relief to tie that bag and Margaret and I shook hands and congratulated each other on our debut as animal collectors.

Back at the Bell's house we left the Goanna, bag and all, on the verandah and started making plans for his transport to West Burleigh.

Late that night I heard a scuffling noise on the verandah and rushed out to investigate. I had a

**kes are among the many kinds of food
shed by Goannas. Here a large liz-
is attacking a venomous Black Snake,
which will be swallowed in a few gulps.**

Both photographs by David Fleay

***This is how you immobilize a Goanna if
it has to be picked up — the trick is to
seize the lizard before it has a chance to
bite. This Goanna is "Dandaraga Dan."***

suspicion about the knots we had tied — and, sure enough, I found an empty bag and no Goanna. However, luck was still with us for he wasn't far away and was just wandering aimlessly in the dark. He had apparently forced his way through the top of the bag. It was more than a relief to find he had not vanished into the night, for he probably would have returned during the hot days to feast on the products of the Bells' fowl pen.

Soon after I arrived he began to walk up and down the verandah with that peculiar, almost mechanical, motion of all large Goannas. Luckily it was possible to herd him into a bedroom and slam the door shut. I then called for assistance and Mrs. Bell and Margaret came to the rescue. We had an exciting time recapturing that big reptile. He reared up on his hind legs, presenting a fearsome sight as he uttered terrific hissing

sounds, ready to take on all comers. From a safe position on a bed Mrs. Bell cleverly slipped a strong noose around his neck and held on. He scrabbled under a chest of drawers with Mrs. Bell in tow, and it took all our combined strength to drag him out and grab him behind the head again. Once more we forced him into the bag and tied it — securely this time. We then enclosed the whole thing in a stout box and the next day loaded him on the first train south. I felt quite proud of holding up the family tradition.

Today "Dandaraga Dan" as we call him is the king of the "Goanna Run" here at West Burleigh. He is constantly on the lookout for a tasty meal of eggs, meat or large eels. Perhaps he sometimes longs for his far-off home in the Gidgee scrub, but I doubt it, for he leads an idyllic existence, lazing in the sun, eating well and living in another self-dug burrow. Above all he is secure from rifles and guns and I really think when he winks those little eyes he is telling me I didn't do so badly by him after all. Goannas do a lot of good by killing and eating venomous snakes and although they look dangerous, they are not such bad fellows after all.





ZOO NEWS IN PICTURES

Photographs by
SAM DUNTON





Springtime

Down in the southwest corner of the Zoological Park, where visitors who arrive at the Crotona Gate see it first, is one of the prettiest springtime sights of the Bronx Zoo — a heard of 10 **BLACKBUCK** originally from the plains of India. Blackbuck are by no means uncommon in zoological parks, but few herds have such an open, wild setting as ours. The herd was established in 1941 and all its present members were born in the Zoological Park. Springtime always sees a good deal of mock fighting between the herd buck and a young buck not yet old enough to seriously challenge his elder. *Above:* Although we have had a sizeable flock of **AMERICAN** and **CHILEAN FLAMINGOES** for many years, they have never nested with us. This spring we built a tiny island in the Flamingo Pond and on the first mild day Curator Conway and Headkeeper of Birds Bell rolled up their sleeves and made an enticing series of mud nests on the island. At least, the nests looked enticing to *them*. Recently the Flamingoes have shown interest in the nests.



To be really lifelike, this photograph should be wired for sound so the coaxing whines of these baby **GRAY** and **HARP SEALS** could be heard — for they “talk” almost incessantly when they are hungry. No one has yet discovered a time when they are *not* willing to eat. Here Tankman DiLauro is offering a fish to one of the two baby Grays, while little Harps approach for a handout. The seals are exhibited in outdoor pools at the Aquarium. Two Harps came to us from C. W. Andrews of the Memorial University of Newfoundland, and 4 Harps and 2 Grays from Paul Montreuil and the Marine Biological Laboratory in the Magdalen Islands of Quebec. All are thriving and they are growing fast.

Three especially interesting new exhibits in the Reptile House are pictured at the top right. At the top is a **DWARF CAIMAN** (*Paleosuchus palpebrosus*) of the upper Amazon valley, the first we have exhibited. It was sent to us by Dr. Frederic Medem of the Instituto de Ciencias Naturales of Bogota. *Center:* The sea snake myth is ancient and hardy — the idea of huge snakes living in the depths of the sea. Nobody has ever captured one of those mythical monsters, but real sea snakes *do* exist and this spring we obtained one. It is the **COMMON BANDER SEA SNAKE** (*Laticauda colubrina*) of the Indo-Australian region, a handsome 5-foot specimen, and was presented to us by Dr. Theodore H. Reed, Director of the National Zoological Park. To date it has not fed voluntarily and is being force-fed on smelts. *Below:* Although it is called the **CAVE SALAMANDER** (*Eurycea lucifuga*) and is usually found in the twilight zone of caves in the highlands of the central United States, this strongly-marked, black-and-orange amphibian occasionally is found outside under rocks and damp wood. Ours was picked up in a cave in eastern Tennessee by Howard Sloane. It has not fed





DESERT POCKET MOUSE
Perognathus penicillatus penicillatus



PACK RAT
Neotoma albigula albigula



BAILEY POCKET MOUSE
Perognathus baileyi baileyi

Really small mammals such as mice and wood rats seldom make spectacular exhibits, because their habits are largely nocturnal and by choice they sleep during the day. A few, however, are willing to stir about in the hours when visitors are in the Zoological Park, and we have just put some of these on exhibition in the Small Mammal House — the ones pictured above and to the left. Most interesting to easterners is the Pack Rat (or Wood Rat) which figures in so many tales of the West because of its habit of carrying away small objects to decorate its nest. Some of the Pack Rats are called “Trade Rats” because they often leave a pebble or other worthless thing as an “exchange.” A single baby was born to our Pack Rats in May.



Last fall we obtained a pair of tiny **HARLEQUIN QUAILS**, an East African species, and were delighted this spring when the female began laying. The eggs, small and white, were simply dropped on the sandy floor of a compartment in the Bird House. We incubated them, and 19 hatched. It was just in time, for the female died on April 25. This chick is 3 days old.

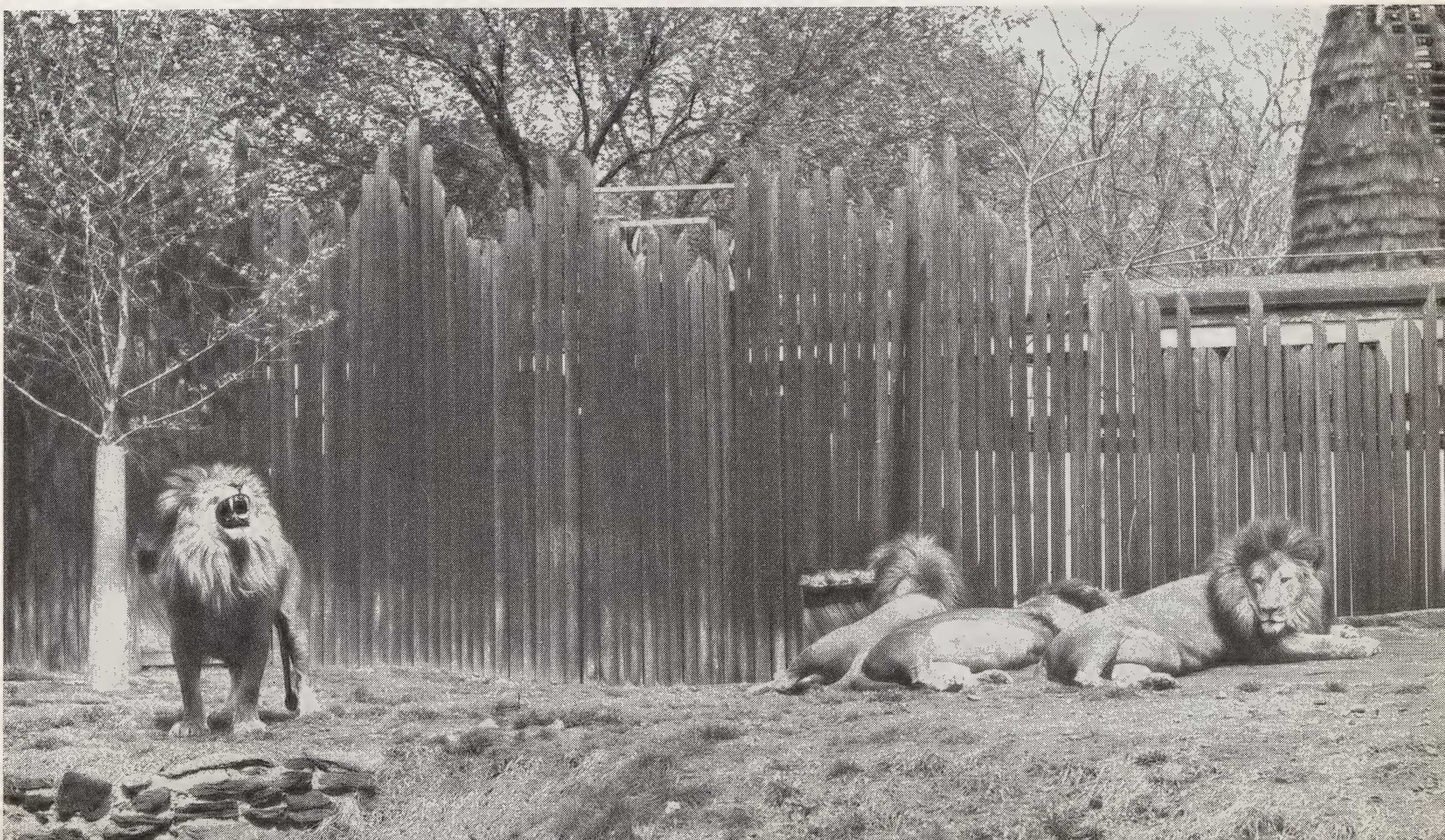


COUES GRASSHOPPER MOUSE
Onychomys torridus torridus



BANNER-TAILED KANGAROO RAT
Dipodomys spectabilis spectabilis

This, too, is a springtime picture, for the photographer brought back word that the **LION** at the left, while apparently roaring his defiance of the world, was really expressing his feelings in quite another way — by a very big yawn. These inhabitants of our African Plains exhibit are now about nine years old and they have settled into a middle-aged calm that only becomes more pronounced in warm spring weather. Consequently, they are being advertised for sale to other zoos and we are seeking five 6-months-old male cubs to enliven the exhibit.





The Nene Can Be Saved

By DILLON RIPLEY

Associate Professor of Zoology, Yale University

ON JULY 29, 1955, there was an excited telephone call between Dave Woodside, Wildlife Biologist of the Hawaiian Territorial Division of Fish and Game in Hilo, Hawaii, and his boss, Vernon Brock, Director of the Division, at his office in Honolulu. Woodside had just spent seventeen hours observing a flock of more than twenty Hawaiian Geese, the first such flock of more than just a very few birds to have been seen by human eyes in eighteen years! Woodside reported that the birds were rather tame, that they were feeding on rattail grass seeds, and that the area seemed to be a definite feeding ground.

That was the start of an intensive campaign to save the Nene, the Hawaiian Goose, rarest species of waterfowl in the world. The Nene is the only goose in the world which has evolved as a distinct species, markedly different from any other known kind of goose, on a tropical island. It is a small bird, half the size of our common Canada Goose.

Above: Posed on an overlook position on a dead branch, a Nene gander stands guard; there is a nest in the vicinity. Right: As fog rolls over the bleak lava field in the distance, a Nene gander leaves its nest and flies away, calling to distract the attention of the photographer. The foreground shows a "kipuka" in the region of lava flows — a patch of grass and low trees.

In color it is not too unlike the common Canada, although the pattern is different. The Nene has a black head and back of the neck but the rest of the neck is light buff-colored, the breast and flanks a soft grayish-brown, mottled on the flanks, and the back a dark umber brown, the tail and wings blackish. But what sets this goose apart is the long black legs, longer than in other species. The Nene is a landlubber, rarely going into the water on its home range, and the feet as a corollary to this have very much reduced webs between the toes.

The Hawaiian Goose occurs only in the Hawaiian Islands and, in addition, it has a highly restricted range within the group. This has apparently always been so. Even in the early days of foreign exploration of the Islands, the Nene had a limited habitat, being reported only from certain parts of the main Island of Hawaii, with a few records for near-by Maui, Kauai and little Niihau. There are no records for Oahu, the Island of the capital city, Honolulu.

Where Woodside watched his wonderful flock of Nene, and where I have walked over the Saddle Road as it is called, the slope between Mauna Loa and Mauna Kea at 6,000 feet above sea level, the tropical air of Hawaii blows chill. Usually there is fog, or the thick gray clouds rolling round the upper shoulders of the great volcanic peaks let down scattered bursts of cold rain. The country of the lava flows is barren and bleak. Recent

These kipuka meadows, scattered here and there in the wilderness of fog, lava flows and heavy tangles of forest, are the last home of the Nene. Here it is making a stand for survival, helped finally by man.

The trouble with the Nene in the old days was that the species was naturally tame. The birds became very friendly as captives. Young birds reared by the Hawaiians would tame up like pet dogs, following their owners around devotedly. One early explorer stated that Nene were much less suspicious than mainland species of geese, not rising high when disturbed but flying off near the surface of the ground.

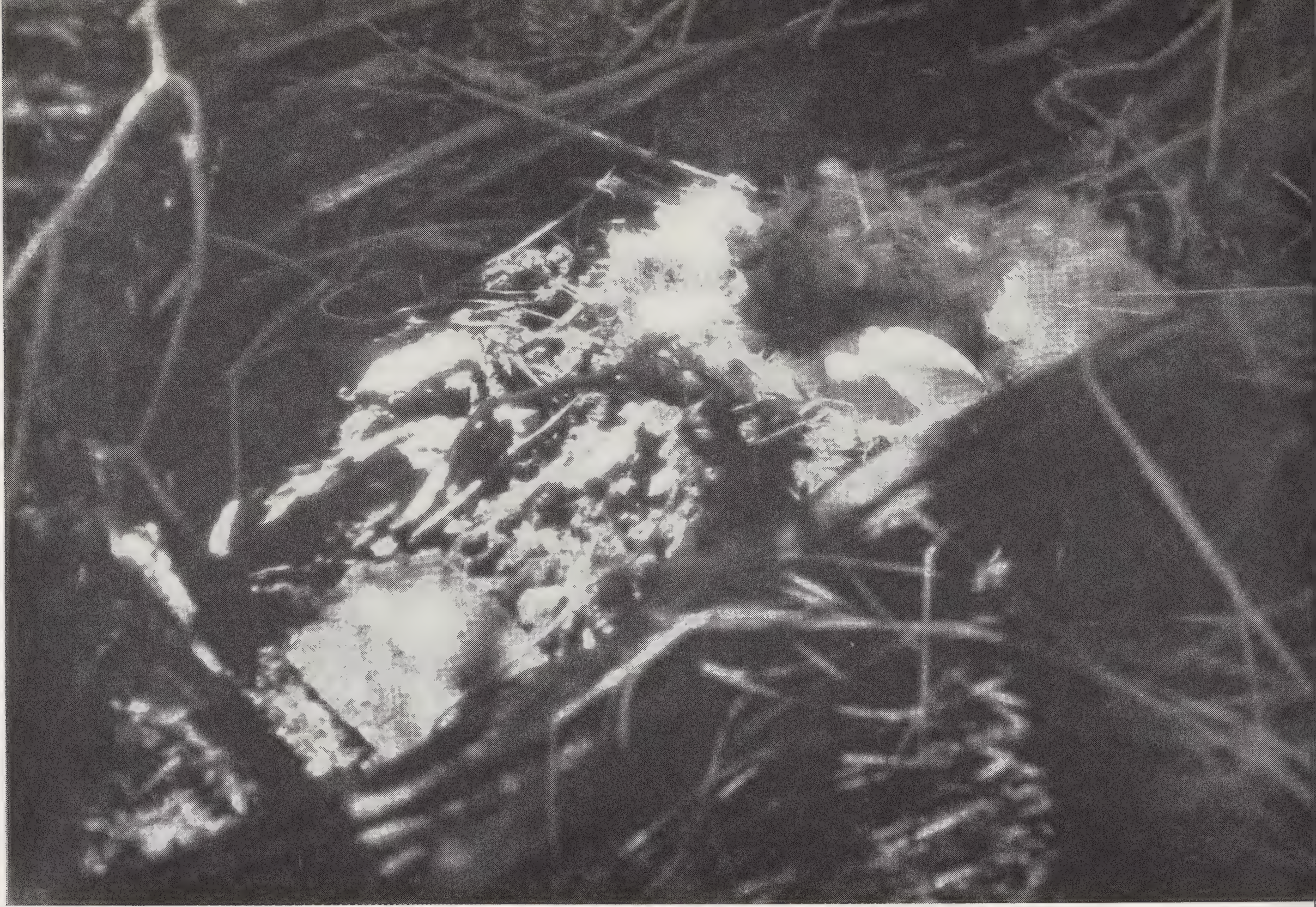
With the advent of the foreigner the Nene was in serious trouble. Hunting of the bird by the Polynesian inhabitants had occurred prior to white settlement, and stories are told of the rounding-up of Nene during the season when



fields, up to sixty or more years old, are just bare expanses of cracked and broken black lava, to cut the shoes and numb the imagination with their sere and other-world appearance.

The older lava flows, where the rock has disintegrated under the hammering of the rainy climate, support life. There is a whole succession of stages, from the "kipuka," an island of meadow land covered with a variety of grasses and tender shrubs, to the occasional stands of stunted and dwarfed forest, heavy bushes, trees and tree ferns, ranked close together in a dank and dripping jungle.

they molt their long feathers, cannot fly, and can be herded like sheep. But systematic hunting with guns was much worse. The original hunting season for Hawaiian Geese was in our winter, in December, a time similar to the waterfowl hunting season in the United States. The Nene unfortunately breeds in December, but this fact was disregarded. Birds were shot as they were nesting, thus destroying the young or eggs as well as the adults. They were good to eat, too. In a book written eighty years ago, an English traveller with the delightful name of J. W. Boddam-Whetham, describing his stay at a vanished hotel



called the Volcano House on the slopes of Mount Kilauea, says that among other "luxuries" he ate "strawberry-fed goose, which had been enveloped in leaves and baked in a hole in the earth." The "strawberries" refer to a native berry found growing on the kipukas at 5,000-foot altitude.

Other enemies arrived as well. The mongoose, an indefatigable hunter, was introduced in 1883 to kill rats and soon turned to the more tempting game of birds and their eggs. Wild pigs became a problem. Originally a domestic breed, these animals now run wild on Hawaii and the other islands, and are common on the high slopes of the great mountains. Pigs would undoubtedly munch goose eggs with pleasure should they come on a sitting bird while foraging. Dogs have become wild on the upper slopes of Mauna Kea and Mauna Loa although they are not numerous, and presumably prefer to run domestic stock such as sheep and goats. Finally, diseases of birds were introduced along with some of the many thousands of North American and European game birds and small colorful birds introduced by various organizations of new settlers, pining for the familiar birds of their home lands. Under this onslaught, many of the native bird species retreated to the highest hills and stole away into a state of extinction. The Nene nearly departed

Above: A wild Nene's nest, with two eggs. When this photograph was taken by Wm. H. Elder, the goose had left the nest to feed.

Right: This volcanic landscape is the Nene's sanctuary, a foraging place. Old stone walls are almost the only landmarks.

this life along with the smaller species, the colorful, Hawaiian-named "Mamo," the "Kioea," the "OO" and the "Moho." By the time George C. Munro's book on Hawaiian birds was published during World War II, he was able to report that Nene had been placed under protection and no shooting was allowed.

This was a step in the right direction. For the situation was now desperate. Where a population of at least "thousands" of this goose had been reported in the previous century, a recent census of 1951 reported ten birds seen on Hawaii and three birds in the island of Molokai. It was thought at the time that the Molokai group were stragglers from Hawaii, and perhaps represented part of the flock of ten. General estimates all through the years since World War II have ranged from twenty-five to thirty birds in the

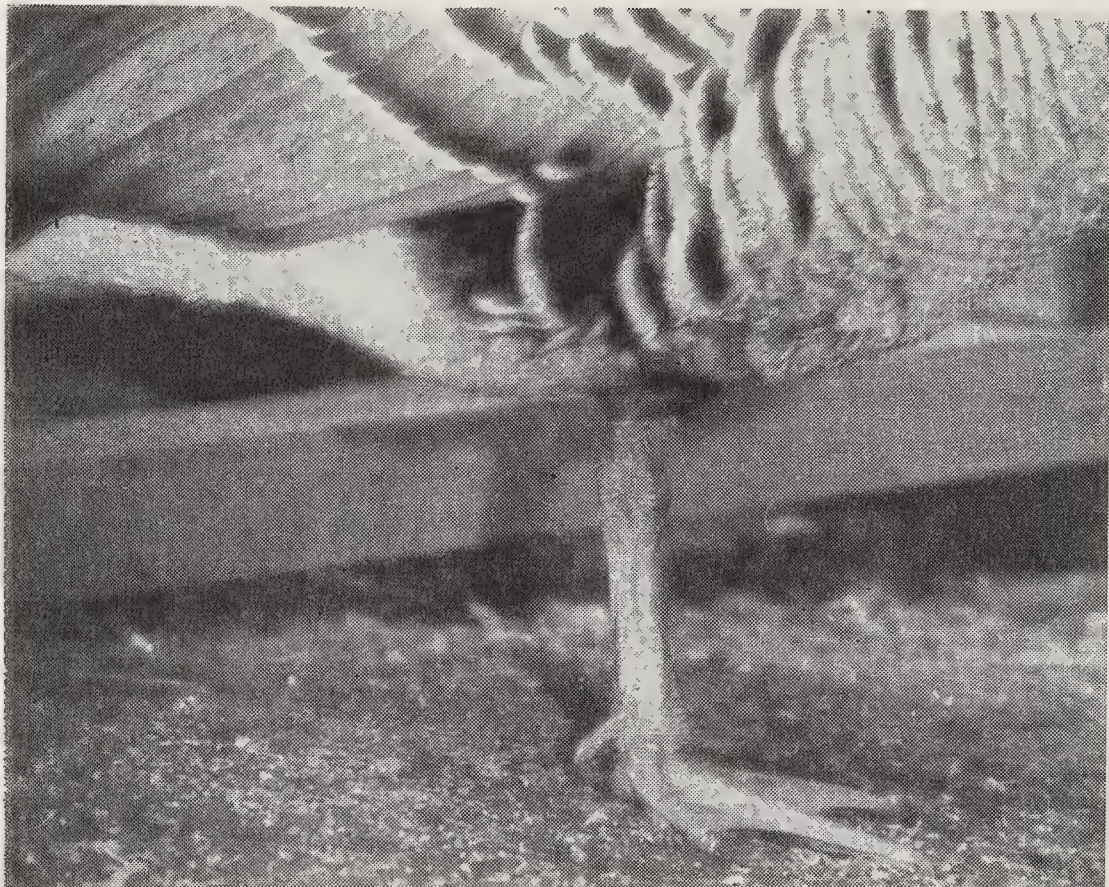
wild state, although no observer actually saw more than ten.

In the meantime attempts had been made to keep the Hawaiian Goose in captivity. The first pair of birds had been imported into England in 1823. For many years after that the Nene lived and was bred in captivity in England, and later in Holland and France. For lack of proper co-ordination and management, however, the stock dwindled, and finally died out in the interval between the two World Wars. Efforts in Hawaii were nearly as unsuccessful. A few ranchers had kept Nene on their farm ponds in the 'nineties, but rats managed to account for most of the young that were hatched from the captive birds' eggs. In 1939, when I first visited the Honolulu Zoo, I saw three Nene that had been reared in captivity by the Fish and Game Division of the Territory. These birds had come from stock kept over the years by the one man who has done more than any other to keep the light of hope

burning for the Nene, Herbert C. Shipman of Hawaii. Mr. Shipman has kept a small stock of captive Nene going on his two farms near Hilo for many years, in spite of the onslaughts of rats, disease, volcanic eruptions, tidal waves and assorted acts of God. His birds have been the only ones which have persisted, and they have served as a reservoir on which to pin the future hopes of the species.

By 1949 the Government of Hawaii decided to take an active interest in a Nene-rearing program. This decision was prompted by wildlife surveys by U. S. experts, such as Dr. Charles Schwarz and Dr. Paul Baldwin, as well as the exhortations of numerous conservationists. A former CCC camp, high up on the slope of Mauna Kea near the Saddle Road at 6,000 feet, was chosen to house the project. The camp at Pohakuloa was thought to be suitable because it was in natural Nene territory. Pens were built and six birds were rounded up at first, four from Mr. Shipman

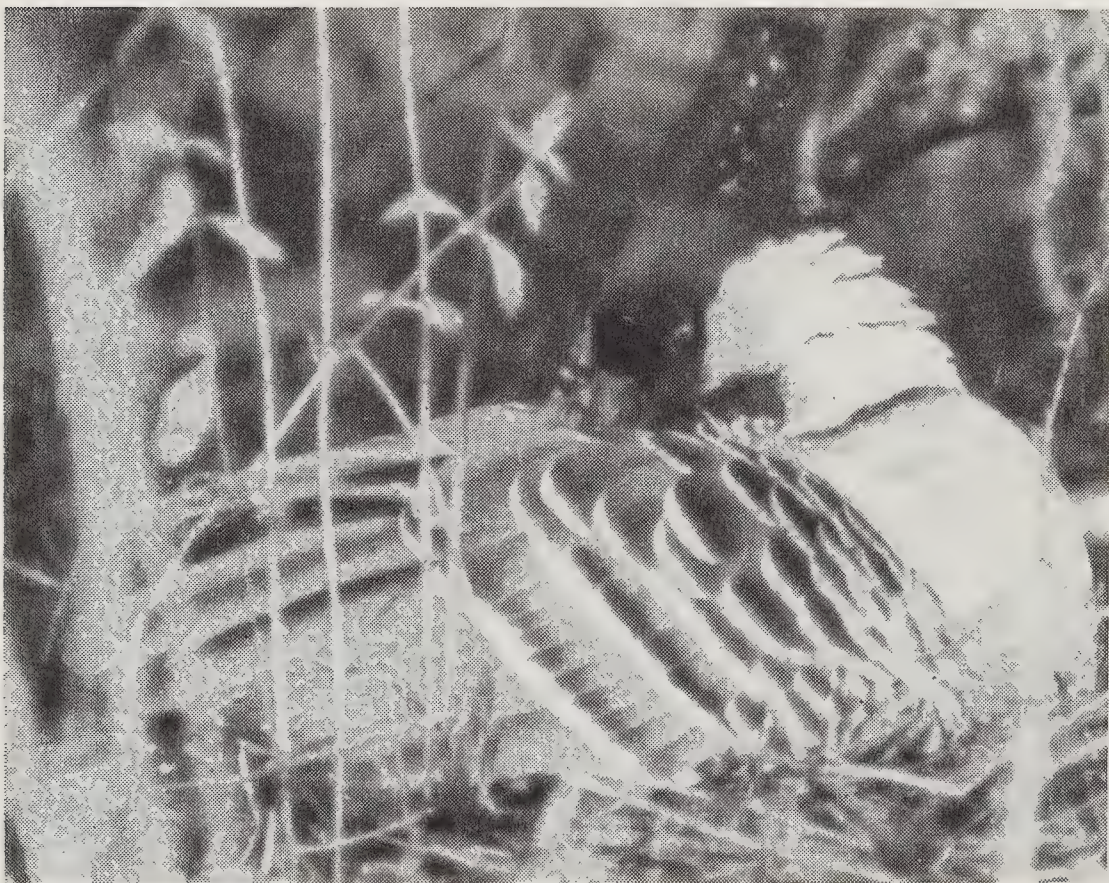




This guarding gander stood on one foot for 20 minutes. Note slight web between the toes.



Eggs must be turned during incubation and here a captive goose is using her beak to turn one.



Unwilling to leave her nest, an incubating female drinks drops of rain collected on her back.

and two, including one wild-caught female, from the Honolulu Zoo. A young technician, Donald Smith, was put in charge. The first season in 1949 was a disappointment and no birds were reared although one of Mr. Shipman's pairs nested. During the second season, aid from overseas arrived in the person of John Yealland, a quiet, efficient rearer of ducks and geese from England, who was in charge of the waterfowl raising program at Peter Scott's Wildlife Trust. Peter Scott, one of the most remarkable figures of his generation, who combines the talents of artist, waterfowl expert, lecturer, small boat skipper, pilot and television idol, had started his Wildfowl organization after World War II in order to focus public interest on the plight of waterfowl in general, and to serve as a clearing house, at least in Western Europe, on all sorts of information and research about ducks, geese and swans. Yealland's experience was just what the Pohakuloa project needed. That season two young were successfully reared.

Mr. Shipman, persuaded of the usefulness of spreading his treasures, sent a pair of his geese back to England with Yealland on his return. The Wildfowl Trust, well-equipped by experience to handle rare geese and to breed them in captivity, was the obvious place to undertake some intensive rearing. But fate intervened. In March, 1951, both Nene proceeded to sit down and make nests. Male and female Nene look alike, and even the experts can be fooled. A hurry-call cable to Hawaii from England resulted in the fastest transport of a Hawaiian Goose on record. In exactly seven days from the arrival of the two sets of goose eggs, a live gander was flown in from the Government project at Pohakuloa. But it was too late for that season. The Hawaiian Nene breeding season was already over. Nene nest in Hawaii in December and January. In our temperate climate nesting comes later, in very late February or March. The geese greeted the gander with enthusiasm, according to Peter Scott's report, but the gander did not respond.

But 1952 was a banner year for the Wildfowl Trust. In that year nine young were successfully reared from the two geese, with both of whom the gander, appropriately named Kamehameha after one of the greatest of the Hawaiian Kings, had mated. The flock was off to a flying start.



This photograph of a guarding wild gander was taken on hatching day just as he turned at the summons of the nesting goose's call.

At the Pohakuloa Nene Restoration Project in Hawaii, two banded adult geese parade with their young, two six-weeks-old goslings.



Since then there has been nothing but success to report. A few losses and accidents have been more than made up for by the added numbers reared each year. In the autumn of 1957, there were fifty-two Nene in Europe, a striking increase from the original of six years before.

MEANWHILE, there was that exciting telephone call in 1955 in Hawaii. The sighting of a flock of wild Nene, after so many years, lent real impetus to planning for the future. If Nene could somehow survive in the wild state, then there was more than ever a real point to the captive program. Not only would captive rearing insure that this unique species would continue to exist, but there was a hope that some way might be found of aiding the wild population. Obviously, if a survey could be made of the wild flock, if some of the questions that intrigued biologists could be answered, there might still be hope for a wild population of Nene.

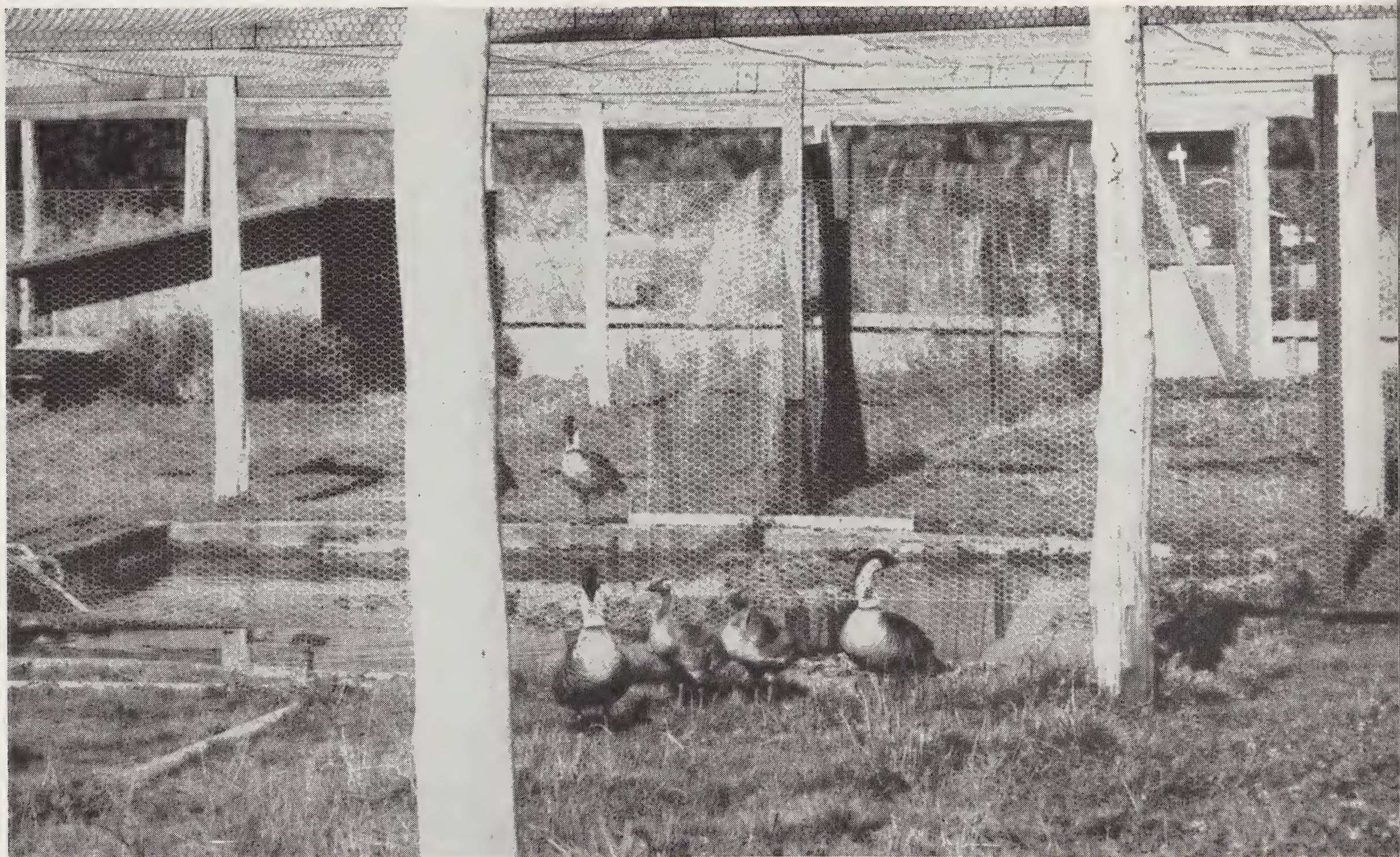
Was disease, the mongoose, or wild pigs responsible for keeping down their numbers? Was the restricted range of the geese a factor? Sugar plantations have taken over where Nene used to roam at lower elevations. Were there seasonal

food or water shortages on the high mountain slopes? Much of this could be answered if a full-time survey could be made. Putting their heads together, the Hawaii Territorial Board of Agriculture and Forestry, the Bishop Museum, Yale University and the International Committee for Bird Preservation found a candidate in Prof. William Elder, a lean, soft-spoken Missourian who had done important work on the native Canada Goose of North America.

Funds were secured, including a Guggenheim Fellowship, and Dr. Elder arranged a year's leave from the University of Missouri. Already his research has produced much interesting and valuable data about the life cycle of wild Nene, the stages of feather molt which leave the adults

Right: Peter Scott of the Wildfowl Trust in England, with some of the Hawaiian Geese reared there. It illustrates the tameness of the birds.

Below: There are ideal facilities in these rearing pens at the Pohakuloa project in Hawaii — pools and clover turf, a protective covering screen.





helpless for a time after the breeding season, and the development of feathering in the young. Last December, Elder and Woodside discovered nests of wild Nene, four of them, exactly where old-timers reported that the wild flocks used to nest half a century ago. Waterfowl are very conservative creatures. They are greatly ruled by tradition. And so the remaining Nene, at least twenty-eight of them, still cling to the tiny, wind-swept patches of grassland amid the raw lava flows as had their ancestors, high on the mist-shrouded slopes of Mauna Loa.

And there has been more progress. The good efforts of the unofficial Nene Committee, spearheaded by the energetic Director of the Honolulu Zoo, Paul Breese, have resulted in the Nene being made the Official Bird of Hawaii as of May 7, 1957, by action of the Hawaiian Legislature. Negotiations are under way with prominent ranch-owners and estate trustees on Hawaii to attempt to set aside the land where the Nene are now known to nest as an inviolate refuge,

safe from hunting and from the attacks of predators. If a Nene park can be set up, with one stout wire-enclosed pen to keep out predators, it is hoped to experiment with a gradual introduction of captive-reared birds back into the wild flock. This will be the acid test for aviculture. If a species can be saved in this way, it may mark a new understanding of practical conservation techniques.

If we who are interested in wildlife and its future can do something to preserve threatened species, tiding them over bad times and the buffeting of a changing environment, it may be the beginning of a new trend toward saving other threatened and vanishing species. It is seldom indeed that man, the perennially restless changer of his surroundings, has a chance to make such positive efforts to save an otherwise doomed species. Now, after a few years' hard work, with a population of approximately one hundred Nene in captivity, and at least twenty-eight wild birds — now, at last, the Nene is coming back.

*In the
Small Mammal House*

Now:

TWO
RARE
INSECTIVORES

By WILLIAM BRIDGES

TWENTY-ODD YEARS AGO when this magazine last published an extended account of the Hispaniolan (or Haitian) Solenodon, the Director of the National Zoological Park contributed the comment that "in 1910, when exhibiting the solenodons, we had at the same time a tenrec in the collection."

The Bronx Zoo, too, had had Solenodons in its collection in 1910, and was properly envious of Washington's good fortune in being able to show both of these rare and curious and distantly related insectivores. Now, at last, we can do it. We have a Hispaniolan Solenodon (*Solenodon paradoxus*) and a Tenrec (*Tenrec ecaudatus*) on exhibition in the Small Mammal House. That they sleep most of the day and are seldom more than partly visible makes no difference — they *do*, when they feel like it, stir and move about in the daylight hours, and they *are* authentic rarities.

The Hispaniolan Solenodon was described scientifically in 1833 but knowledge of it was almost a blank until 1907 when three specimens were captured for the American Museum of Natural History. Several living Solenodons came out of Haiti and San Domingo in 1910 and we received three.

One died within a week and the others not





TENREC
Tenrec ecaudatus

HISPANIOLAN SOLENODON
Solenodon paradoxus

long afterward. At long intervals we have had a few more—in 1935, 1949, and now one that came on April 12 of this year and seems to be in excellent health and spirits.

There is another Solenodon, the Cuban, but it has not been seen for many years and is probably extinct. For that matter, the little animal still found in Haiti and San Domingo may not be long for this world, on account of mongooses, cats and dogs.

Although it has been known for so long, not much is accurately known about the Solenodon's life in the wild. It is an insect-eater, but does not

disdain small snakes and tiny burrowing mammals. With us it thrives on an improbable but nevertheless well-rounded diet of watered-down evaporated milk, chopped horsemeat, codliver oil, bone meal and the yolk of an egg.

Just how closely related are the Solenodon of the West Indies and the Tenrec of Madagascar is a debated point; each is in a separate family, and they are certainly far removed in space and time. Both are insectivores. Both are rare in zoological collections. We have, indeed, had but four Tenrecs in earlier years, the last in 1914. This is the more surprising because Tenrecs appear to be plentiful in Madagascar—the only place in the world where they are found. Our present species is said to have 15 to 21 young at a birth. It goes to sleep underground from June to December and the natives dig it out for food.

News from the Conservation Foundation

Pesticides and Forest Spraying

Chemicals such as DDT are being used more and more extensively in forest management, but many questions remain regarding their effect on fish and wildlife, on forest growth and regeneration, and even their long-range effect on insect pests. Through conversations with landowners in Maine, we have encouraged new research on some of these aspects of pesticide use. In June, 300,000 acres in Aroostook County will be sprayed against the spruce budworm. The Maine State agencies will observe spraying effects, especially on fish, and, owing to our interest, this research will include effects on the aquatic insects on which local fish feed. Over three years, Dr. G. M. Woodwell of the University of Maine will study the effects of DDT on seed germination and seedling growth — matters clearly vital to the economic future of the area.

Businessmen and Conservation

In late April a most successful conference was held at the University of Michigan on "Natural and Human Resources in Area Development." This conference, organized by Roger Hale, was attended by about 100 persons from many parts of the country — from universities, industrial corporations, utilities, and planning agencies. Its purpose was to bring together people of a wide range of interests sensitive to American resource-use problems, especially those who are alert to aspects of space-use planning, the relationship between sound resource management and sound economics, and population trends.

Some of the topics discussed included "Training Needs for Land Planning," "Urban and Rural Relationships" and "The Impact of Industrialization on Low Income Farm Areas." The proceedings of the conference will shortly be published and distributed. More than four thousand copies will be sent out to business leaders, planners, economists and educational institutions interested in improving training programs for those who will be responsible for decisions in resource management in years to come.

Oil Drilling Operations

Roger Hale attended an informal conference called by Fred A. Seaton, Secretary of the Interior, on the conflicts that develop when wildlife and wilderness areas of the National Parks and other Federal lands are drilled for oil. Representatives of many major domestic oil companies and of several conservation organizations participated. While no definite policy resulted from the discussions, progress was made toward a better rapport between the oil companies and conservation groups. Similar meetings are planned for the future.

Pesticide Program Against Fire Ant

The fire ant is now a serious problem, causing extensive damage to croplands and to economic activities in at least eight Southern states. The Federal Government, in collaboration with State agencies, has already begun an intensive campaign against this pest. Several chemical pesticides, including the extremely toxic agent dieldrin, are being used. It is quite possible that this campaign may have highly injurious effects on many forms of animal life because present knowledge of the ecological consequences of such programs is still extremely inadequate. Dr. John L. George, author of an earlier study, *The Pesticide Problem*, sponsored by the Society and the Foundation, is making a field survey of the fire ant operations. He will attempt to evaluate the possible effects of the operations on wildlife populations, and also make specific recommendations for the research work that is clearly indicated if pest control programs are to be safe as well as effective.

The Trustees

Harold Dodds, President Emeritus of Princeton University, and David M. Heyman, President of the New York Foundation, have been elected members of the Board of Trustees.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Everything Is Ready for the Duck-billed Platypuses

As this issue of ANIMAL KINGDOM goes to press, we are awaiting cabled word from David Fleay as to the date on which he expects to arrive in New York by air with two or possibly three young Duck-billed Platypuses. Two we are sure of—Paul and Pamela. A second female, captured in mid-May and named Patty, may or may not be sufficiently air-minded to make the trip. Latest reports are hopeful however.

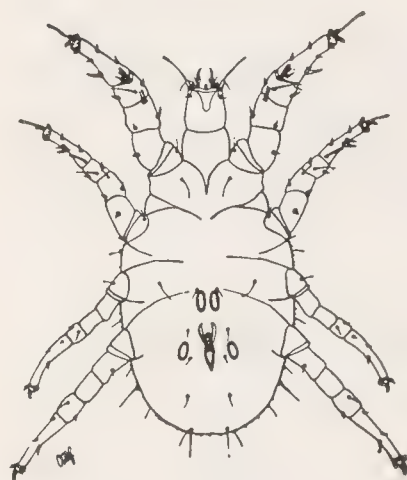
Everything is in readiness to receive them here, whether there are two or three. A hitch developed at one point when the U. S. Department of Agriculture ruled that Australian soil, the habitat of earthworms Mr. Fleay must carry with him to feed the babies en route, could not be permitted to enter Hawaii, one of the stopping places of the plane. It was proposed that the earthworms be carried in damp sphagnum moss, but experiment showed that Paul and Pamela disliked sphagnum-bedded earthworms and would not eat them. Subsequently the Department of Agriculture agreed that sterilized Australian soil could be brought into Hawaii, where it would be confiscated and the worms transferred to sterilized Hawaiian soil after they were rinsed.

The Platypusary in the center of the Zoological Park has been repaired and repainted, the winter storage Platypusary in the basement of the Lion House has been reconditioned, and regular and copious food supplies have been arranged for—crayfish from Louisiana, frogs from New Jersey and and earthworms from Florida.

Mite that Killed Goldfish Named for Dr. Nigrelli

When a tankful of newly acquired Goldfish began to die mysteriously in the spring of 1953, Dr. Nigrelli, the Aquarium's Pathologist, made

a routine check and discovered that some small mites, slightly more than 1/100 of an inch long, were apparently killing the fish. These relatives of ticks and spiders are found all over the world, but none had ever been known to attack fish. Further investigation showed that a poison produced by the mites was causing the Goldfish's death. Water in which mites had lived quickly killed healthy Goldfish and Guppies, even after being carefully filtered to remove the tiny crea-



*Histiotoma
nigrellii*

tures, and the toxicity of the water could be correlated with the number of mites that had lived in it. The tank was immediately quarantined, and no further attack occurred until the following year, when mites briefly appeared again in the same aquarium. Since then we have had no more trouble with mites.

This was a unique experience; it was therefore important to find out exactly what species of mite was responsible. Dr. Nigrelli turned to Dr. Roscoe D. Hughes of the Medical College of Virginia, an acknowledged authority on the classification and biology of mites. What he found out made the incident seem even more remarkable. A different, but related, species was involved in each attack. The two mites belong to a large Family of mites usually found on decaying organic matter. No member had ever before been found living in water. One species had been described from Java and Sumatra in 1931. The other turned out to be new—a species previously unknown to science. Dr. Hughes and his collaborator, Dr. Caroline Goode Jackson, have described it in a recent issue of *The Virginia Journal of Science*. They have named it *Histiotoma nigrellii* in honor of Dr. Nigrelli.—J. W. A.



President Osborn, in the hall of the Administration Building at the Zoological Park, displays a Sulphur-crested Cockatoo to some of the Consuls General and their wives, of 24 countries, who made a tour of the Zoo on May 15. At Dr. Osborn's right is Richard C. Patterson, Jr., Commissioner of Commerce and Public Events, who arranged tour.

Children's Zoo Has Its 5,000,000th Visitor

During the first week of the Children's Zoo's eighteenth season, the 5,000,000th visitor passed under the bridge that spans the entrance. Whether the visitor was a child, and walked in upright, or an adult and had to stoop to go under the low bridge, we do not know. Attendance records indicated that the 5,000,000th visitor would enter about ten days later, but a combination of good weather and publicity attending the opening on April 5 was such that the Children's Zoo was swamped. Normally 10 to 12 per cent. of the Zoological Park's attendance on Sundays and holidays pays to enter the Children's Zoo; the figure is 20 per cent. on the three days each week when admission is charged to the Zoo. But during the three days of the Easter holiday, the Children's Zoo drew 30 per cent. of the total attendance. On opening day, it was the second highest in eighteen years.

Curator Conway Attending Meeting in Helsinki

Curator of Birds William G. Conway left at the end of May to attend the meetings of the International Ornithological Union and the International Committee for Bird Preservation in Helsinki, as the representative of the Zoological Society. Before his departure he was elected secretary of the American group attending the meetings.

He will visit several European zoological parks before returning near the end of June.

Staff Changes at the Zoological Park

Dr. James A. Oliver, Curator of Reptiles since September 1, 1951, assumed the additional duties of Assistant Director on May 15 following the resignation of Dr. Leonard J. Goss, Veterinarian and Assistant Director. Dr. Goss on May 15 became Director of the Cleveland Zoological Park.

At the same time Dr. Charles P. Gandal, Assistant Veterinarian, became Veterinarian.

Dr. Goss came to the Bronx Zoo on August 1, 1939. He has taken on the directorship of one of the young and vigorous zoos of the mid-West, with several excellent buildings, an interesting collection and a reputation for enthusiastic local support, and in his new job he has the best wishes of the staff of the Bronx Zoo and his many friends in the Zoological Society.

Antelope House Gets New Roof, First Since Opening in 1903

When a major reconstruction job has to be performed on an animal building—such as a new roof—it is highly desirable to remove the animals. Sometimes, however, this is impracticable, and that is largely so in the re-roofing of the Antelope House that began near the end of May. Built in 1903, the building has never been completely re-roofed and the time has come when it has to be done.

Antelopes and Giraffes, unfortunately, are easily frightened by unusual noises and activity, and would certainly not take kindly to roofers working directly overhead. Consequently the job will be done in two stages and while each side

of the building is being worked on, its animals will be temporarily quartered in the African Plains antelope shelter.

IN BRIEF

No Cobra Eggs. For the past three years the female King Cobra in the reptile collection has laid a clutch of eggs on April 24. This year, no eggs.

Cancer Studies. The latest use to which the special strains of fishes from our Genetics Laboratory are being put is to test the theory that viruses are the cause of cancer. Dr. Helen V. Coates, D.V.M., of the Department of Pathobiology of the Johns Hopkins Medical School, is now starting a series of experiments on fishes specially bred for the purpose by Dr. Myron Gordon. It is hoped that these experiments will reveal whether a virus is in any way responsible for the hereditary pigmented tumors found in our hybrid fishes.

Art in the Tetons. Paul Bransom, the animal illustrator who maintained a studio in the Zoological Park in its early years, has established an outdoor art school at Jackson Hole, Wyoming. With him, under the name of "Teton Artists Associated," are Conrad Schwiering and Grant Hagan. Classes for amateur and professional artists are held three days a week during July and August.

PUBLICATIONS OF INTEREST

SNAKES IN FACT AND FICTION. By James A. Oliver. 199 pp., 20 photographs. The Macmillan Company, New York, 1958. \$4.95.

Curators of Reptiles, by one definition, are people who spend their lives correcting the public's mis-information about reptiles—above all, snakes. The Bronx Zoo's Curator of Reptiles does the job in wholesale proportions in his new book. The list of chapter headings shows how much territory he covers: Mythical Monsters, Sea Snakes, and Fossils; Giant Snakes; More Giant Snakes; Prodigious Meals; Aggressive Snakes; Dangerous Snakes; Snake Charmers; Family Life; Snakes in Numbers; No Snakes in Ireland; Enemies—Real and Imaginary; and Memorable Moments, this latter being some lively accounts of "extraordinary occurrences" he and other herpetologists have lived through. Giant snakes are a subject that fascinates Dr. Oliver (as it does many laymen), and he devotes two chapters to a survey of the literature. His own conclusion is that Anacondas probably do, occasionally, attain a length of 37 feet and

perhaps somewhat more. Throughout the book Dr. Oliver has quoted extensively from old and modern accounts of snakes, always setting the record straight when it is necessary to do so and not avoiding giving his own informed opinion. The result is a book that can be read with pleasure by anyone, and with profit by beginning and amateur herpetologists. — W. BR.

A PADDLING OF DUCKS. By Dillon Ripley. 256 pp., 34 illus. and jacket designs by Francis Lee Jaques. Harcourt, Brace and Company, New York, 1957. \$6.

This is a thoroughly enjoyable book. Dillon Ripley, Curator of Vertebrate Zoology at the Peabody Museum and Associate Professor of Zoology at Yale University, tells in a delightful and literary fashion of his long association with waterfowl. By the time Dr. Ripley was seventeen he had constructed a small duck pond. From this beginning he takes the reader through twenty-five years of watching, breeding and searching for waterfowl in far-flung places. As the subjects arise, Ripley's narrative flows through sound discussions of his hatching, rearing and feeding procedures as well as informative historical notes of captive waterfowl, and waterfowl of the world in general. Especially interesting is his account of the Spedan-Lewis, Terry Jones waterfowl rearing techniques in England, and a wonderful tale of a visit to the famous Sir David Ezra in Calcutta. Thirty-four fine black and white illustrations by Francis Lee Jaques add greatly to the enjoyment of the book.

The increasing importance of aviculture in present-day ornithology and conservation is repeatedly delineated by Dr. Ripley. Those interested in natural history whose backyards are too small for duck ponds should read this book with caution! — W. G. CONWAY

ZOOGEOGRAPHY—THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS. By Philip J. Darlington, Jr. Pp. xiv + 675, 80 figures. John Wiley & Sons, Inc., New York, 1957. \$15.00.

The distribution of animal life on the earth is a subject of great fascination for the layman and scientist alike. Both are aware that particular species are found only in certain parts of the world and not in others. Thus, everyone knows that polar bears are found only in the Arctic, whereas penguins are characteristic of the Antarctic area and are absent from the northern cold regions. The scientist is interested in the details of distribution patterns and the reasons for them.

One scientist who has devoted a great deal of energy and time to these matters is Harvard University's Philip J. Darlington, Jr. Dr. Darlington is primarily an entomologist, but he has always been interested in the study of zoogeography. This book is the result of his studies in this field, and it is an excellent testimony of how well he has spent his time.

"Zoogeography" outlines the distribution patterns of the different groups of vertebrates, analyzes these patterns and endeavors to explain their origin. The author then reconstructs the past history of the vertebrates in relation to their evolution and distribution. Finally he evaluates the principles of zoogeography and reviews the geographical history of man. The serious student of natural history will find much of interest and enlightenment in this outstanding book. — J. A. O.

SEALS, SEA LIONS AND WALRUSES. By Victor B. Scheffer. Illus. 3 tables, 15 figures and 63 photographs and drawings in black and white. 179 pp. Stanford University Press, Stanford, Cal., 1958. \$5.00.

The Seals are mammals of very special interest, not only for the beauty of the fur produced by some species

but for their great physical variation, ranging from the grace of the Sea Lion to the gargantuan bulk of the Elephant Seal. Although a voluminous literature has been built up over the years, the references are scattered and not for many years has a general review of the entire group appeared. Mr. Scheffer is especially well equipped for the task, through extended study and field work in the interests of the U.S. Fish and Wildlife Service. There is much technical material, of course, and there are controversial uses of nomenclature, since there is wide divergence between authorities on such matters. But this book will be welcomed by technical workers and there is enough general information to satisfy the layman. — L. S. CRANDALL

SPIDERS, SCORPIONS, CENTIPEDES AND MITES. By J. L. Cloudsley-Thompson. 228 pp., 17 black and white illus. and 39 figs. Pergamon Press, New York, 1958. \$9.00.

There are a number of semi-popular books on insects and marine Arthropoda. Cloudsley-Thompson has written about the lesser known members of the phylum. Though the reader is required to have some zoological background, I know of no other book that presents the sow-bugs, millipeds, harvestmen, solfugids, ticks and other rather obscure orders of terrestrial arthropods in such readable form. Besides giving the usual classification and distribution of each group, he gives the all too frequently omitted information on food, enemies, behavior and life cycles. — H. S. FLEMING

New Members of the New York Zoological Society

(Between March 1 and April 30, 1958)

Life

Alexander Aldrich
William C. Beller
Otto Marx, Jr.
Joseph A. Thomas

Supporting

Miss Cornelia Van A. Chapin
Mrs. Benjamin Gilbert
Mrs. E. Roland Harriman
Mrs. Archer M. Huntington
Mrs. Albert Spalding
John T. Terry
Miss Alice Tully
Orme Wilson

Contributing

Arthur L. Barnett
Mrs. Walter C. Bent
Nicholas F. Brady
Mrs. R. Rionda Braga
Mrs. J. Ogden Bulkley
Robert C. Burtnett
Mrs. C. Reed Cary
Mrs. Hobart Cook
Gerry J. Dietz
G. Chester Doubleday
Mrs. Samuel Dunaif
George Edgar
Mrs. Shirley C. Fisk
Eliot Freidson
Mrs. John D. Gordan
Robert J. Hamerslag
Walter Hoving
Mrs. Howell Howard
Frank E. Karelsen
Mrs. Joseph M. Kirchheimer
W. Roy Manny
Alastair B. Martin
Lee McCanliss
Mrs. Margaret P. Mendell
Edmund Prentis
Henry Reynolds
Mrs. Hilda C. Rodman
Mrs. Frank B. Rowell
Frederick A. O. Schwarz
Michael Gordon Thompson
Joseph Walker

Charles J. Wallace
Admiral George M. Wauchope
Mrs. Frank A. Weil
Mrs. Robert Wise
William L. Wisner, Jr.

Annual

Mrs. Thomas P. Almy
Arthur W. Ambler
Edward H. Anderson
Jerry Armus
Miss Ann McD. Bannerman
C. Francis Beatty
Dr. Raymond T. Beldegreen
Dr. Morris H. Bernstein
Mrs. Edward H. R. Blitzer
Sidney Blum
Miss Rachel Helen Bones
Harry D. Boyce
Mrs. Arnold C. Brackman
Daniel A. Brener
Frank J. Brennan
Miss Mabel W. Brown
Harry I. Cobern
Frank P. Connor
Miss Patricia A. Cousins
Richard J. Crohn
Joseph E. Deems
Sam Deitchman
Miss Florence E. Donnelly
Miss Ethelwyn Doolittle
Miss F. Belle Figger
Mrs. E. C. K. Finch
Dr. Bernard D. Fine
Mrs. Morris R. Fischer
Andrew Fisher
Mrs. Michael Fitzmaurice
Miss Doris Foster
J. W. Fredericks
Mrs. Sylvia M. Friedlander
Mordecai L. Gabriel
Gordon S. Gavan
Mrs. Robert Gordon
Dr. Jean M. Gould
Bernard F. Greene
Price B. Hall, Jr.
Robert Halsband
Dr. Victor Herbert

Mrs. Alexandrina MacG. Hersey
Edward S. Hodgson
Seymour Katz
James C. Kennedy
Mrs. Daniel Klein
Daniel B. Knock
Richard Kool
Allan Kramer
Frank Kramer, Jr.
E. H. Kuehn
Dr. Ben Marr Lanman
Mrs. Burton Lasky
Mrs. Edmundo Lassalle
Miss Paige Mallory
B. L. Mazel
Mrs. Roberta McCormick
William Mezzabarba
Mrs. Joseph F. G. Miller
Eli C. Minkoff
Joseph Mintzer
Miss Anna N. Nelson
Andrew E. Norman
Mrs. Dorothy S. Norman
Innis O'Rourke, Jr.
Mrs. Selig Paskin
Mrs. Ray Patelski
Mrs. Howard Phipps, Jr.
Theodore M. Pomeroy
Dr. Frank Ratner
Stephen Rosenbaum
Mrs. Jesse Roth, Jr.
Milton Schwartz
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Murray H. Shulman
Mrs. Ruth Simmonds
Mrs. Lawrence Squires
Albert H. Tomlinson
Master Harold M. Tovell
William J. Tully
Mrs. Harold Valk
Miss Florence E. Walsh
Miss Alice W. Wardwell
Frank A. Weil
I. Weintraub
Mrs. Josephine Wendling
Ross F. Williams
Dr. Julius Wolf
Col. Waldo W. Zagat

We're Whooping It Up in the Zoo

Going away for the summer? Send us a postcard with your summer address (and the date of your return to your winter address) so "Animal Kingdom" and special announcements can follow you.

It's not just the animals making sounds all over the Bronx Zoo these days—people are getting into the act. And as usual, the animals are having a hard time figuring out just what the human race is up to now.

It all began with a seemingly small and innocuous idea. Let's make up an animal sound quiz, we thought innocently, to amuse distinguished guests at Zoo luncheons. (Every Spring the Century Association, the University Club and the Coffee House Club schedule Zoo luncheons for their Members). And so we devised an animal sound quiz that everybody was happy about—until we tried it out for the first time.

Guests were asked to listen to a few animal sounds and choose, among three possibilities, the animal they felt might have made that sound. For example, we played a recording of the Great Horned Owl's hoot and listed these possible choices: Owl, Bushbaby, Yellow-breasted Chat. Another quiz sound was the brassy chatter of the Australian Laughing Jackass or Kookaburra, and we listed the choices as Kookaburra, Chattering Chachalaca, and Hyena.

Well . . . we *were* surprised at the results, because practically no one got anything right. (Of course, it must be remembered these Club Members were not Zoological Society Members). But another totally unpredictable thing happened: Just about everybody tied for winner with two right answers out of the possible 11!

That left only one thing to do and, smiling grimly and apologetically at our animals, we did it. We lined up all the tied winners and held a contest to determine who could make an animal sound—a hoot, hiss or a whoop—that sounded anything at all like the original.

The results were unforgettable.

For our part, we don't really dare to go too near the Owl Aviary—now that people have tried to horn in on that great owl's inimitable call.

MEMBERSHIP CHAIRMAN
THE ZOOLOGICAL PARK
New York 60, N. Y.



ANIMAL KINGDOM



AN OFFICIAL PUBLICATION OF THE NEW YORK SOCIETY OF ZOOLOGISTS

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

A Useless Law

AT THE PRESENT moment a new piece of legislation is before Congress, which represents a fine example of a "useless law." It is H.R. 12126 and calls for a ban on the import of wild ruminants from abroad. This proposed legislation has passed the House and is now before the Senate. Should it be enacted, it would mean that hereafter such remarkable animals as giraffes, okapi, antelopes and other hoofed and horned animals could not be brought into this country.

The purpose of this legislation is avowedly to prevent foreign wild animals from bringing in disease which might affect our own domestic animals. The fact is, however, that existing quarantine regulations are so thorough and so well applied that no single case of hoof and mouth disease has ever been attributed to wild animals that have passed through the government's quarantine. Further, the number of wild ruminants imported annually during the past ten years is very limited. As another practical matter, all large public zoos are located in urban areas where the collections have no direct contact with domestic herds.

More than 60 million people visit the public zoos in our country each year. If the proposed legislation should be enacted, visitors to our zoos will never have the opportunity of seeing many remarkable animals from other parts of the world after the existing collections die out.

Together with other zoological parks, we are making every effort to prevent passage of this unnecessary and undesirable law.

Fairfield Osborn



Paul, Pamela and Patty--

Platypuses in the Zoo Again!

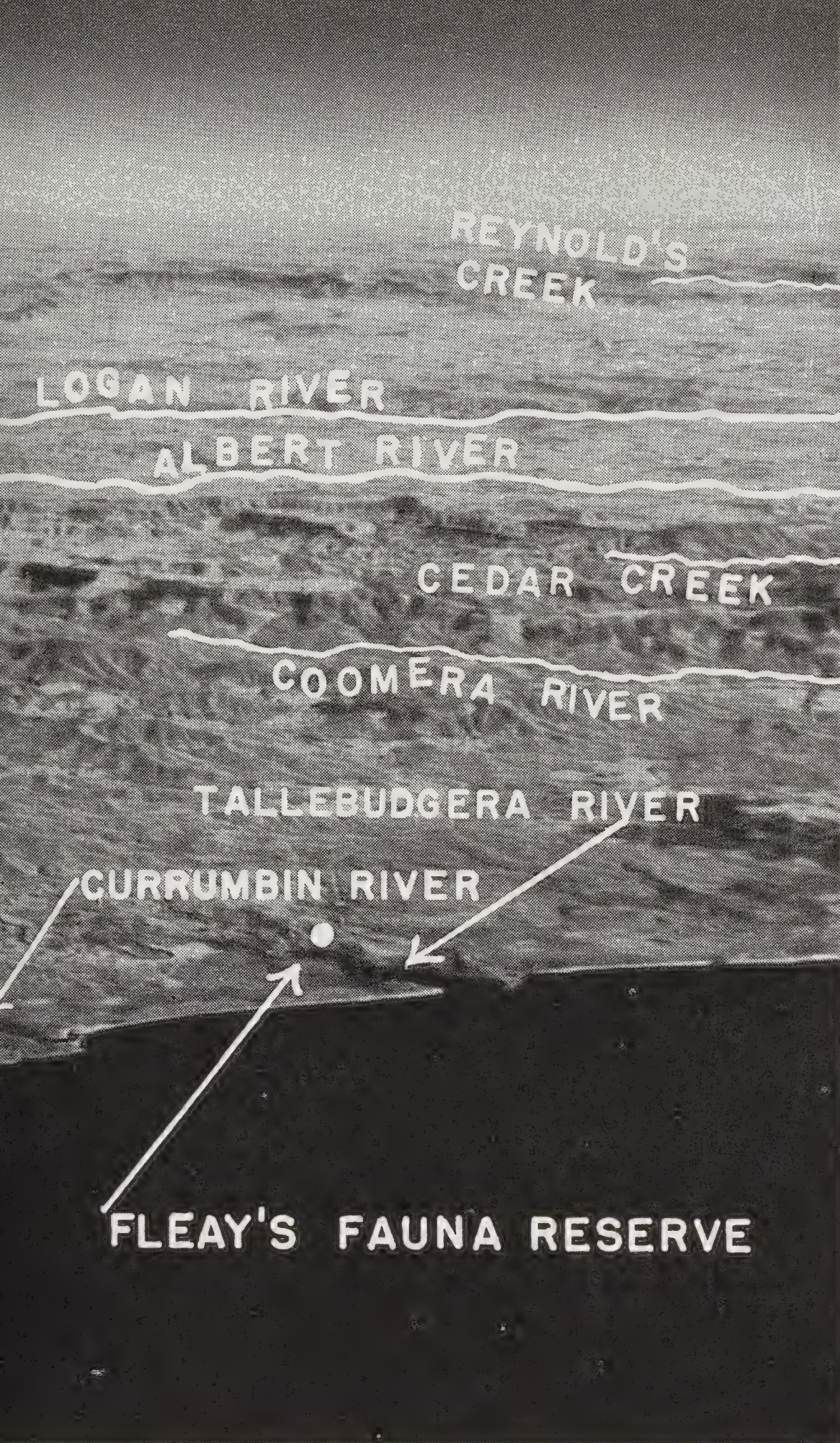
By DAVID FLEAY

Fauna Reserve, West Burleigh, Queensland, Australia

IN AN AERIAL PHOTOGRAPH the eastern coast of Australia looks rugged. It is. Not, perhaps, to the holiday-making people of Brisbane and further-away cities who lie on the sandy beaches at Christmas and revel in the sub-tropical warmth of southern Queensland, but when I look at that photograph I translate every wrinkle and every fold in those foothills and mountains into obstacles to the capture of Duck-billed Platypuses.

Even now, when it is all over and Paul, Pamela and Patty are seemingly settled in their commodious Platypusary in the Bronx Zoo and I am on the eve of returning to my home overlooking one of the loveliest of the Queensland beaches, I find it hard to relax. It will be a long time before the tensions of the past six months drain away.

When the New York Zoological Society in 1946 asked me to capture, condition and transport three Platypuses to the Bronx Zoo, the job



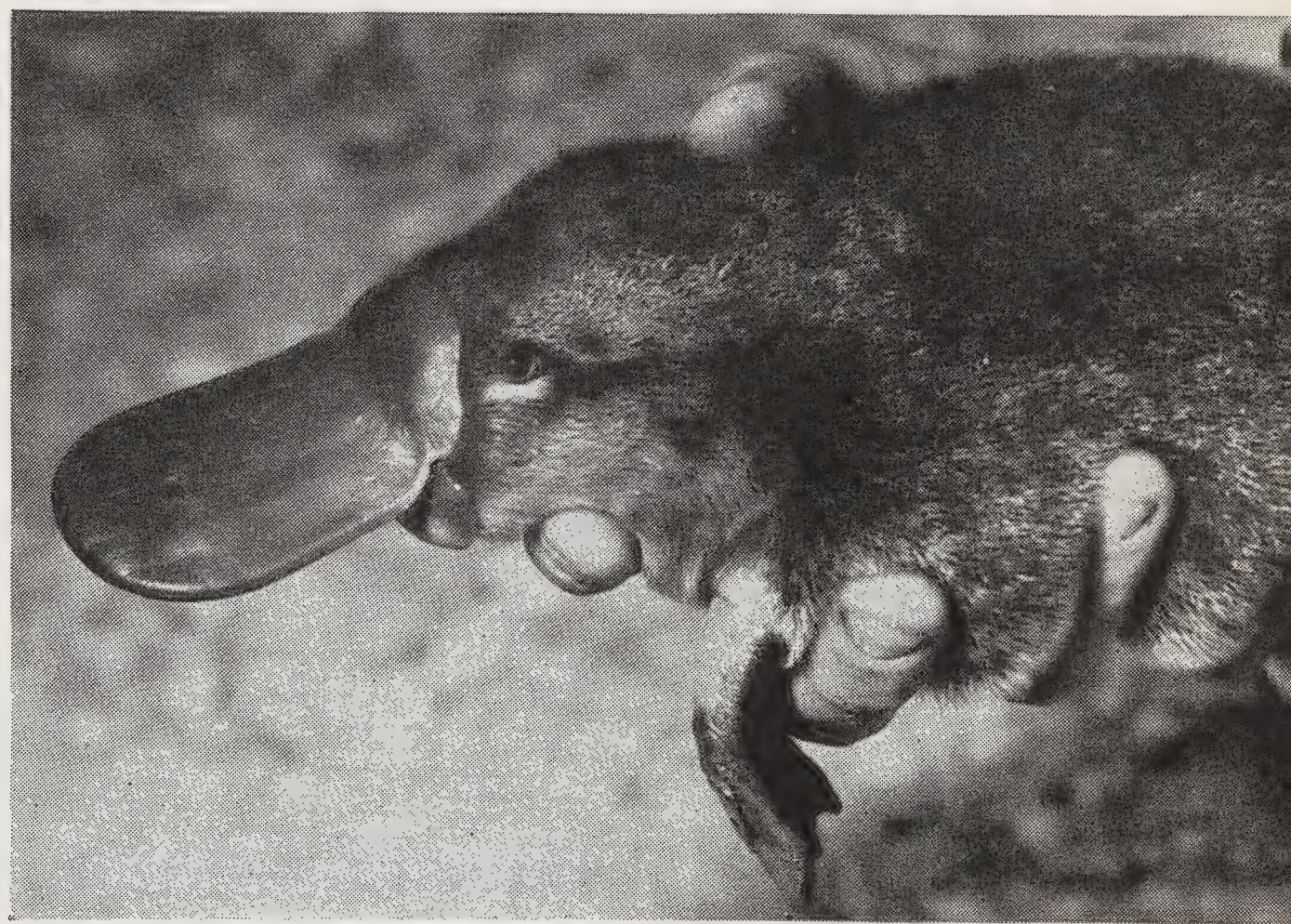
From his home at West Burleigh, Mr. Fleay had to range more than a hundred miles inland, in extremely rough and broken country, to reach the rivers and small streams inhabited by the Duck-billed Platypuses he brought to New York. Altogether he drove about 8,000 miles.

Photo by Courier-Mail, Brisbane.

presented obvious but, I felt, surmountable difficulties. For one thing, I was living in Victoria, a thousand miles to the south of my present home, and it was a good "Platypus season;" these furry little links between reptiles and present-day mammals were reasonably plentiful in several streams roundabout. Indeed, in only three weeks of hunting, I caught 19 from which it was no trick at all to select three beauties — Cecil, Penelope and Betty. For a year I kept them in the Sir Colin Mackenzie Sanctuary in Healesville until they were thoroughly accustomed to visitors and the routine of daily exhibition. Then came a lei-



PAUL



PAMELA



PATTY

surely, month-long journey by sea from Australia to America. There *were* incidents, of course, but how minor compared with those of the past few months!

When Dr. John Tee-Van wrote me near the end of 1957 to confirm what the Australian newspapers had already reported in detail — that Penelope had disappeared and Cecil had died 49 days later (Betty having died in 1948) — I had been thinking for some time how I would go about it if the Zoological Society wanted me to try again. First, permission of the Queensland and Commonwealth Governments would have to be obtained, for the Platypus is one of our most strictly protected animals. Permission, I thought, would be likely to be forthcoming, in view of the Zoological Society's remarkable record in keeping Cecil and Penelope for more than ten years.

The thing to do, I decided, was to capture very young animals and condition them rapidly, then to transport them to New York by air as Dr. Tee-Van suggested. About air transport I had my doubts, for Platypuses are definitely not air-minded and are apt to show their resentment of noise and vibration by going off their feed and, in a few days, simply dying. But perhaps youngsters would be more amenable to the air age.

In any event, the Zoological Society planned to send Dr. Leonard Goss out to Australia and transport would be his responsibility. The search for youngsters would be limited by the breeding season; in Queensland, youngsters hatched early in the spring could be expected to be wandering on their own between early January and mid-February. Moderate rains normally fall throughout the spring and summer, feeding rivers which are a rich foraging ground for these crustacean-minded feeders, and I shouldn't have too much difficulty.

The only trouble was that the rains did *not* come on schedule. Rivers and streams fell lower and lower, shrank to waterholes and in some cases mere mudholes. It was going to be a bad year for Platypuses and I more than half suspected that many females did not even set about digging their long burrows and laying their creamy-white eggs. Even the lesser than usual number of Platypuses that hatched were going to have a hard time making a living in a drought-stricken land.

If the Florida Everglades was criss-crossed by hills and slashed by rocky gullies, I suppose that in a drought season in mid-summer it would be a pretty good imitation of coastal Queensland in its spring-summer drought. The flies, the mosquitoes, the algae-choked pools would be the same. And the heat, the oppressive, burning sun.

Early morning and sundown are the best times to seek Platypuses, for they feed at night and in the waxing or waning light one is most likely to catch a glimpse of the widening circles of water in some pool where a Platypus has crash-dived. And one must work alone, too, at least at first, for if there was ever a shy, timid, easily frightened animal, it is a Platypus. Lonesome work it had to be, then, until I actually located a Platypus and could bring in a helper if necessary to set the traps.

I shan't soon forget the dawn on the morning of January 22, for it was then that I saw the first of those telltale ripples. I had glimpsed them from a distance of several yards from the edge of the Albert River, suspected that a Platypus had caused them, and slowly sank to my knees and began to crawl toward the bank behind a screen of bottle-brush. Sure enough, a tiny, thin, baby Platypus was nuzzling and puddling in the mud of the shore. One glimpse was all I had, for it sensed or saw me and dived.

I froze — figuratively, only. For an hour there was nothing to do but to endure the heat and let the mosquitoes have a field day, for I dared not move to brush them away even momentarily. My stoicism paid off, for eventually the baby came up from under a clump of roots. I was in a position to cut off its retreat to the deeper part of the river and it chose to scramble over rocks and through rivulets to deeper water upstream. It started upstream and I started after it, and for the time being the baby won: it disappeared in a winding crevice of rock.

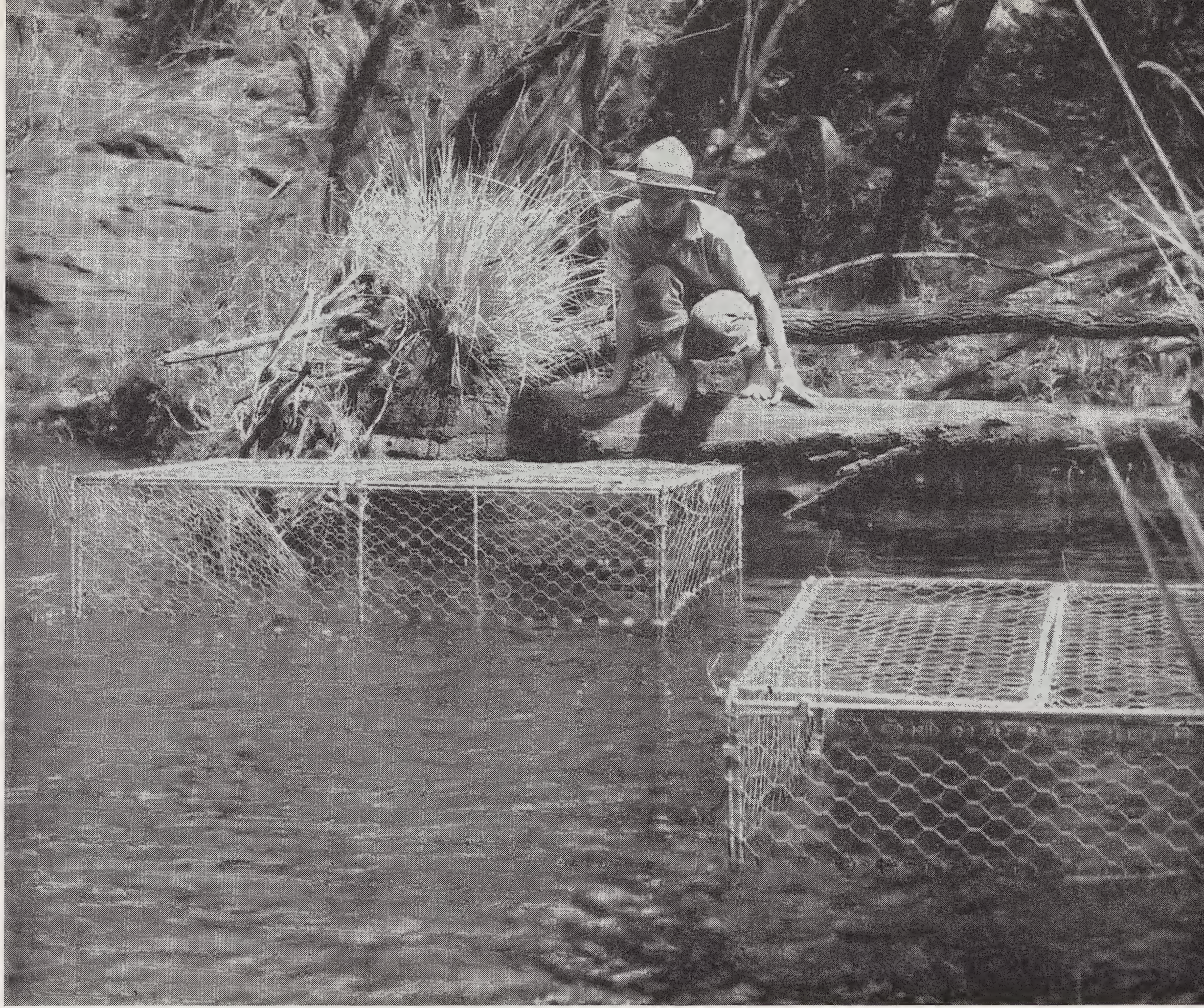
Next to catching it immediately, the best thing was to know just where it was living and feeding. That night I set up my underwater fences in the most likely nearby pool and the following morning Pamela, my first capture, was safe in the trap where the fences converged.

She was, I figured, four months old at that time. She was thin and woefully undernourished and I doubt that she could have survived much



A Platypus lives here. Betty Fleay, the author's daughter, is digging into the site of a nesting burrow at the top of the bank of Palen Creek. The actual burrow entrance is visible as a round, dark spot about a foot above the water, alongside a curved white stick, near the center.

All photos by the author unless otherwise credited.



longer under those terrible conditions of drought.

Within a few hours Pamela was in the special Platypusary I had built at our Fauna Reserve in West Burleigh, and to my delight she showed a complete readiness to eat. Of course, she could take only the smallest of crayfish and worms, but she would eat readily — that was the main thing.

Only four nights later a cage trap in the same section of the Albert River caught a beautiful little male. Things, I thought, were looking up, and for the moment I quit worrying about the monsoon rains that *must* come soon and would turn these fetid ponds into rushing, roaring rivers. This young male, which I named Paul, was one of the best Platypuses I have ever seen. He was in relatively good condition — splendid condition, considering the season — and his coat was sleek and glossy. Furthermore, he was not temperamental; he took fairly readily to captivity and food. Within a few hours he joined half-pound Pamela in the verandah-sheltered, 24-foot-long Platypusary at the West Burleigh Fauna Reserve.

But that was the end of my run of good luck.

In the weeks that followed I drove and tramped many, many hundreds of miles within a radius of a hundred miles of home, wearily working the waterways — the Albert, Coomera, Logan, Curumbin, Cedar (this last about the size and habits of the Bronx River as it flows through Westchester County), and Palen and Burnett's Creeks. Sometimes I endured the heat and the mosquitoes alone, sometimes with Colin Veivers of Cedar Creek. We grew all too accustomed to being startled as big water lizards dropped from overhanging Bean trees into the river pools. We grew resigned to the dashing of our hopes as we made dawn visits to the traps and saw the water swirling as it would if we had a Platypus — invariably the swirl was caused by an eel, or freshwater crabs, or tortoises, or catfish, or poison-finned bull-routs or freshwater mullets. We had, it seemed, run out of luck — or Queensland had run out of Platypuses. The month of February passed in growing despair.

Early one March morning Colin visited our seven traps and out of one pulled an ancient

female Platypus, almost blind and certainly far past her prime. We returned her to the river, for since a Platypus hunts food below the surface with eyes and ears closed, blindness would be no particular obstacle to survival.

One episode I should not like to recall if it had not produced a Platypus. That was the time we camped on Palen Creek, 95 miles from home, arriving after dark and setting our traps on speculation in a long, dark and rather smelly pool. It was not until the next morning that we discovered that the pool contained the carcass of a drought-stricken bullock — which explained, too, why our tea the night before had had a rather gamey flavor. But what does make the incident worth remembering was that our traps the next morning contained a fine young male, almost as good as Paul.

We named him Paddy. We had wanted another female, but the season was now so late that we considered ourselves lucky to have three

rushing waters carried traps away as fast as we could set them up. It was for the most part a desultory kind of persistence, without any real hope. No wonder our road mileage eventually totalled 8,000 miles!

Back at the Fauna Reserve Paul and Pamela and Paddy were behaving beautifully. I put them on a regular routine such as they might encounter in New York, awakening them every afternoon at 3:20 o'clock for their feeding and exhibition to visitors. They took it well, providing we gave them background "music" of falling water, and thrived, so that the food problem became acute. Our own adult male named Percy had to be fed, and the three extra mouths meant that we needed some 3,000 earthworms, countless meal grubs and 40-odd crayfish every day. As long as the drought lasted, all these items were progressively harder to find and at one point I had to push the price of crayfish up to threepence each, of whatever size.

From the very beginning I had had qualms

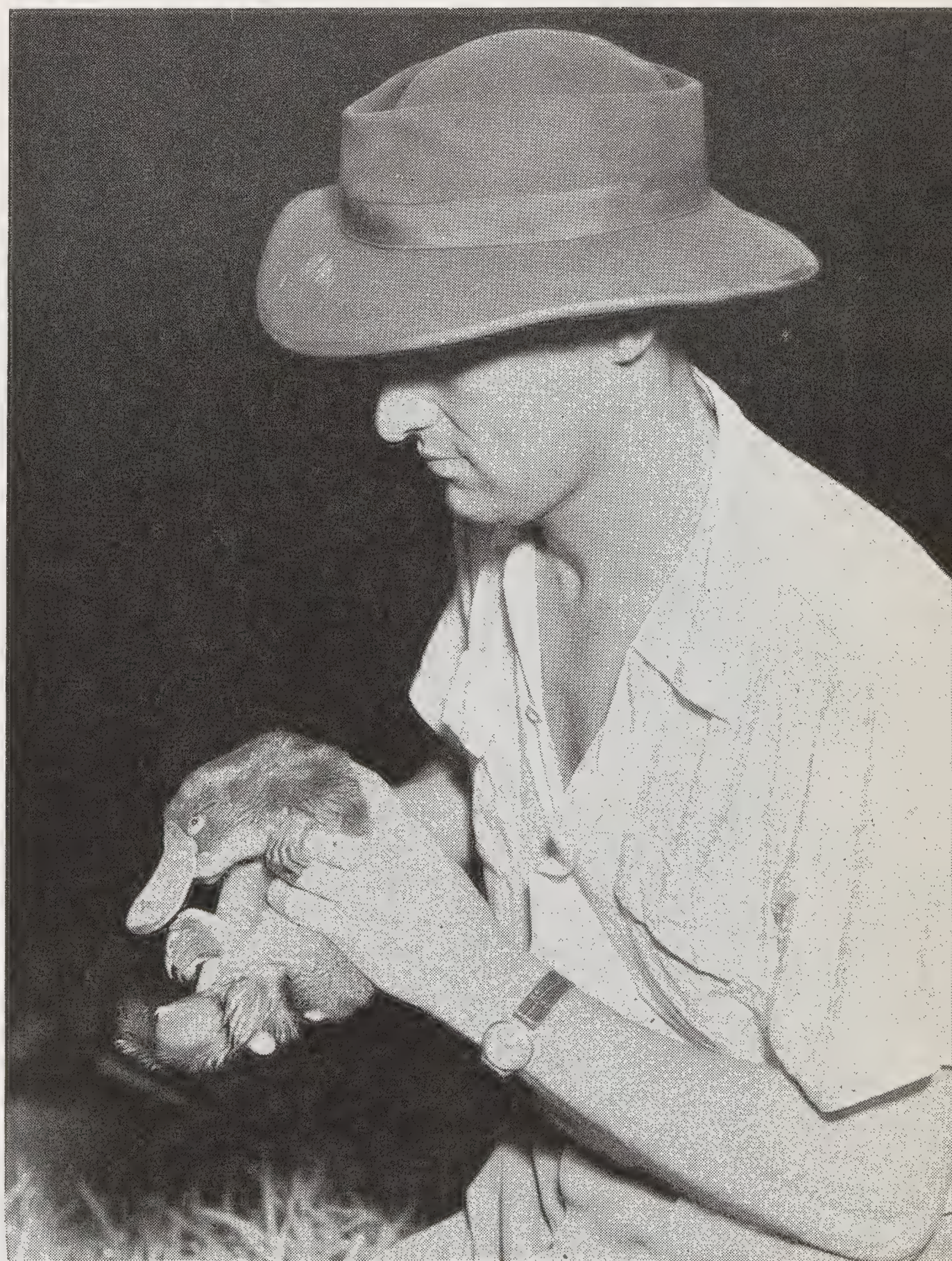
Platypus traps set in the Albert River. Paul was captured in the one on the right, Pamela in the trap at the left. At one time seven traps were in operation.

Paddy, the four-months-old male, was a little beauty, but he was so upset by a test flight in an airplane that he had to be liberated in the Currumbin River.

young animals of whatever sex. It *was* just chance.

Nevertheless, the search persisted. For the first part of March the rains held off and the possible Platypus-harboring sites were comparatively few, so that we felt the population might be concentrated. Certainly there was no lack of evidence that Platypuses *had* been in the Palen Creek area; here and there in the banks we could see the entrances to their burrows, with their flat, oval doorways. Nevertheless, we caught only one animal, an unsuitable, adult male.

The rains came in torrents in mid-March, and so did letters from the New York Zoological Society urging us to persist and try to the very end to get two females and a male. We persisted but the rivers and creeks were now bank-full and the



about air transport, remembering that the Platypuses went off their feed in 1947 at the very start of their trip to New York as the aftermath of a comparatively brief flight of 1,000 miles to catch the ship. So I made an arrangement with Trans-Australia Airlines whereby Paul, Pamela and Paddy, Mrs. Fleay and I, and a couple of magazine correspondents, made a 120-mile flight to Brisbane and back.

Everything seemed satisfactory in Brisbane, but back home they were slightly dazed and that night they refused to eat. Paul and Pamela had recovered within 24 hours, but Paddy was going down fast. Another 24 hours and I liberated him in nearby Currumbin River. He simply wasn't temperamentally capable of surviving the long trip to New York.

So there we were, near the end of March, with only two Platypuses. The rivers were rising and falling, the traps were being washed away and sometimes surviving a night or two. One night in the Albert I caught a huge male — 20½ inches from the tip of his rubbery bill to the end of his tail. He weighed four pounds. He was of no use to us and we turned him loose after photographing him digging his venom spurs into my rolled-up swimming togs.

Spring was coming to New York, but winter was approaching in Queensland and it was no longer pleasant to wade into the rivers to set and visit the traps.

Between expeditions I designed and built a miniature Platypusary that would be home to Paul and Pamela and a possible third Platypus on the air trip to New York. It was 6 feet long, 2 feet wide and 3 feet high, and as light and compact as ingenuity could make it. There was a shelf-protected, bondwood swimming pool, grass-padded tunnels and drying devices. Nevertheless, it weighed 200 pounds without water.

Every second night Paul and Pamela were transferred to this travelling Platypusary, to get

Male Platypuses have sharp venom spurs on their hind legs. A big male 20½ inches long, here shown hanging by his spur from cloth. He was turned loose

A close-up of young Paddy whose dislike for flying was the only thing that kept him from coming to New York. Notice how plump a well-nourished baby is.





them accustomed to it. At first they ate very little and spent most of the night trying to escape. Gradually I changed the burrow system and the landing board until they settled down. On such small details do success or failure so often depend — when you are dealing with Platypuses.

It was about this time that a letter from New York changed my personal plans: Dr. Goss would not be able to come out to Australia, and would I carry on to the very end and deliver the animals to New York? Of course; there was nothing else to do.

As departure time drew near we learned to our dismay that Plant Quarantine Regulations of the U. S. Department of Agriculture would not permit Australian soil to be brought into Hawaii, where the Pan-American plane would set down en route to New York. This was critical, for Platypuses require a certain amount of mud in the water as they nuzzle and puddle for their

food, and we had planned to carry their earthworm food in a five-pound can of Australian soil.

Just to make sure, we washed a night's feeding of earthworms and crayfish and offered them to Paul and Pamela without soil. They refused to eat, and we lost 2,000 earthworms and a good assortment of crayfish — for Platypuses will eat only live food.

Cables between Australia and America and Hawaii passed frequently, and at full rapid rates, for some days and finally it was all worked out — we could bring the Australian soil into Hawaii, but it would be seized and destroyed after the worms had been removed, washed in Hawaiian water and replaced in sterilized Hawaiian soil for the rest of the trip.

Just to make sure that we had no more incidents like the one in 1947, when the Platypuses ran out of food and the Zoological Society had to fly 10,000 earthworms to Panama to meet the boat, I requested that 5,000 earthworms and 5,000 mealworms be airmailed to Hawaii well in advance of our expected arrival. The worms could be shipped in sphagnum moss to save weight, then transferred to Hawaiian soil at least a week before we arrived. That way, they would have the taste of soil to the Platypuses. We knew by experiment that Platypuses will not eat earthworms that have been stored in sphagnum moss right up to mealtime.

Earlier I wrote of our "desultory persistence" in seeking another female. That persistence won. On May 10, in a last desperate try in the narrows of Cedar Creek — right in the middle of a cow pasture — we caught another young female. Colin Veivers had ridden out to check the trap without even carrying a bag, so certain was he that we would have no luck. But there *was* a Platypus in the trap, and Mrs. Veivers phoned excitedly to say that Colin had arrived home with the Platypus wrapped up in his shirt.

The recalcitrant young male we had called Paddy; sticking to alliteration, we named the newcomer Patty. She was older than we would have preferred, probably in her second year, but she was quiet and steady and settled in well with Paul and Pamela. It had been a narrow squeak, but we had just about what we and the New York Zoo wanted: one fine male, and two fine females.

THE SKY was still black and star-studded at 4 a.m. on June 3 when we lifted Paul and Pamela and Patty out of their swimming pool in the big Platypusary in West Burleigh and slid each one into a small, wooden, grass-filled individual carrying case. The Travelling Platypusary had been shipped ahead to Sydney by freight plane and we were to follow with the youngsters in these temporary boxes.

It all began auspiciously. There was no trouble motoring the 65 miles to Brisbane Airport with the babies and their food supply of 10,000 earthworms, 2,500 meal grubs and 550 crayfish. I had bought a thick pad of sponge rubber to cushion the road shocks, and at Brisbane the Trans-Australia Airlines people had provided relatively vibrationless rear seats in a Vickers Viscount.

Another kind of shock began in Sydney. The Pan American Airways plane was delayed in Fiji and it would probably be 48 hours before we could take off for New York.

There was nothing for it but to install the three Duckbills in the Travelling Platypusary in one of the Pan Am hangers and hope for the best.

The best was not very good, for two days' delay meant that we should run out of food even before we got to America. I telegraphed to West

Burleigh to start digging earthworms again — I needed at least 2,000 more, and at least 50 more crayfish. Fortunately there is frequent plane service between Coolangatta (West Burleigh) and Brisbane, and Brisbane and Sydney, and an "earthworm-crayfish airlift" was established. A second shipment of food arrived on June 5, and none too soon, for all the original lot of worms had been consumed. A Sydney hospital sterilized more earth for us.

At noon on June 5 the Pan American plane finally took off with the Travelling Platypusary strapped down on its rubber cushion in the cargo hold, which was also pressurized and temperature-controlled. Because of the two-day delay, the Platypuses started for America in a somewhat restive condition, and I was not greatly surprised when I checked their condition two hours after takeoff to find that Paul and Pamela were frantic, swimming excitedly, rearing up in the corners and falling backward into the water. Behavior of all three rapidly deteriorated. The cause of their disturbance was, of course, the terrific noise and vibration of the four engines pounding away only a few feet on either side.

The first stop was Nandi Airport in Fiji. By that time, wet and bedraggled, the three Platypuses had disappeared into their burrows.

Another takeoff, this time for Canton Island. Dead earthworms and crayfish floated under the landing boards in the Platypusary; the babies had not eaten. By now I was convinced that they would not survive to reach America.

The one spot I dreaded was Honolulu, for it had been agreed that at this first port of call in U. S. territory, the Australian earth would be changed and all grass bedding would be destroyed

This is one night's meal for an adult Platypus. Earthworms and chafer grubs and frogs (in the bottle) are the equivalent of half the weight of the animal.

Mr. and Mrs. Fleay on their arrival at Idlewild on June 7 — and the Platypuses, each in a separate small box in which the trip from Los Angeles was made

Photo by M. Castora



and replaced with Hawaiian bedding — which meant a complete and thorough upset of the Platypuses' lives while they were at low ebb.

It was just as bad as I feared. By the time Mrs. Fleay and I had been courteously escorted through Customs, Health and Immigration formalities, the inspectors had removed the whole Platypusary from the plane without waiting for me to drain the tank — and the water had flooded into the normally dry burrows.

All around us planes were taking off and landing and the air quivered with sound. It was the worst possible condition for disturbing the Platypuses, but it had to be done and so, feeling at complete low ebb myself, I began removing the soaked bedding. I fully expected to find three cold little corpses in the tunnels.

But I didn't. Paul, Pamela and Patty were bundles of nerves, but they were alive! Patty was obviously thinner — a result of not eating.

Paul Breese, Director of the Honolulu Zoo, was standing by to help us and help he did. He had brought the earthworms and mealworms that the Zoological Society had shipped to Honolulu in advance, and he produced quantities of delightfully soft Hawaiian grass to repack the burrows. Never was a friend more welcome.

Thirty-five flying hours and five days out of Queensland we landed at Los Angeles, where we were supposed to lie over until early evening and then take a United Airlines cargo flight for New York — a flight that would consume 16 hours.

One look at the trio in Los Angeles and I knew they would never make it. The only thing to do was to get them to New York by the quickest and most direct transportation possible. That meant a final dash in a non-stop passenger plane, with the Platypuses each in the small travelling cases in which they had started out from West Burleigh, and it also meant imploring United Airlines to stretch a rule against carrying animals in passenger planes.

In New York Miss Davall was making telephone calls to airline officials; in Los Angeles we were convincing other officials, including the commander of the plane, Captain J. D. Milstead, who had the final say, that Platypuses do *not* smell like skunks (they are quite odorless). Providentially United Airlines gave its consent. At nine o'clock on Friday night, June 6, we took off in the non-stop plane for New York's International Airport. The Travelling Platypusary, empty now, followed on the slower and more circuitously-routed cargo plane.





The “unveiling” of the trio took place in the out-of-doors Platypusary on June 13. Looking on are, left to right: President Osborn, Sir Josiah Francis, the Australian Consul General, and Mr. Fleay who is holding little Patty, the youngster who was least disturbed by the trip.

Photo by Nat Fein, Herald Tribune

Virtually the whole Bronx Zoo staff was waiting at Idlewild at 7:30 on Saturday morning, June 7, eleven years and forty-three days from the date of our other arrival in Boston with Cecil, Penelope and Betty on April 25, 1947. The Platypuses were dazed and shocked, and Pamela had developed a nasal discharge that gave me some concern in the next few days. Paul, I think, would have died if the trip had lasted two more hours. Patty, surprisingly, was best of all.

To my insistence that for the time being the youngsters be given *complete* rest and seclusion in the darkness and quiet of the old Platypusary I had used on the 1947 trip, and which was now set up in the basement of the Bird House as a winter storage place for Platypuses, the staff of the Zoological Park gave entire consent. In Joe Neglia, the keeper assigned by the Bronx Zoo to

be the Platypuses’ guardian and friend, I found as apt and interested a student of Platypus behavior as I had found John Blair eleven years before.

On Friday, June 13, 1958, after a luncheon in the Administration Building of the Zoological Park at which President Fairfield Osborn expressed the pleasure of the Zoological Society in having Platypuses again, and the Australian Consul General, Sir Josiah Francis, gave Paul, Pamela and Patty a hearty Australian welcome, we all adjourned to the Zoo’s permanent, out-of-doors Platypusary and a little after 2 o’clock the three Duckbills officially made their debut before — it seemed to me — all the reporters and photographers in New York.

Tomorrow, June 16, Mrs. Fleay and I leave New York to return to West Burleigh, 11,600 miles away in Queensland. Regretful as we are to say goodbye to so many old friends in the New York Zoological Park — and to Paul, Pamela and Patty — we still return with far fewer cares and worries than we had when we set out. The Platypuses are off to a good start, and may they long survive to fascinate Americans — as they do Australians!

Like Everybody Else, Animal Keepers Have Their Favorites

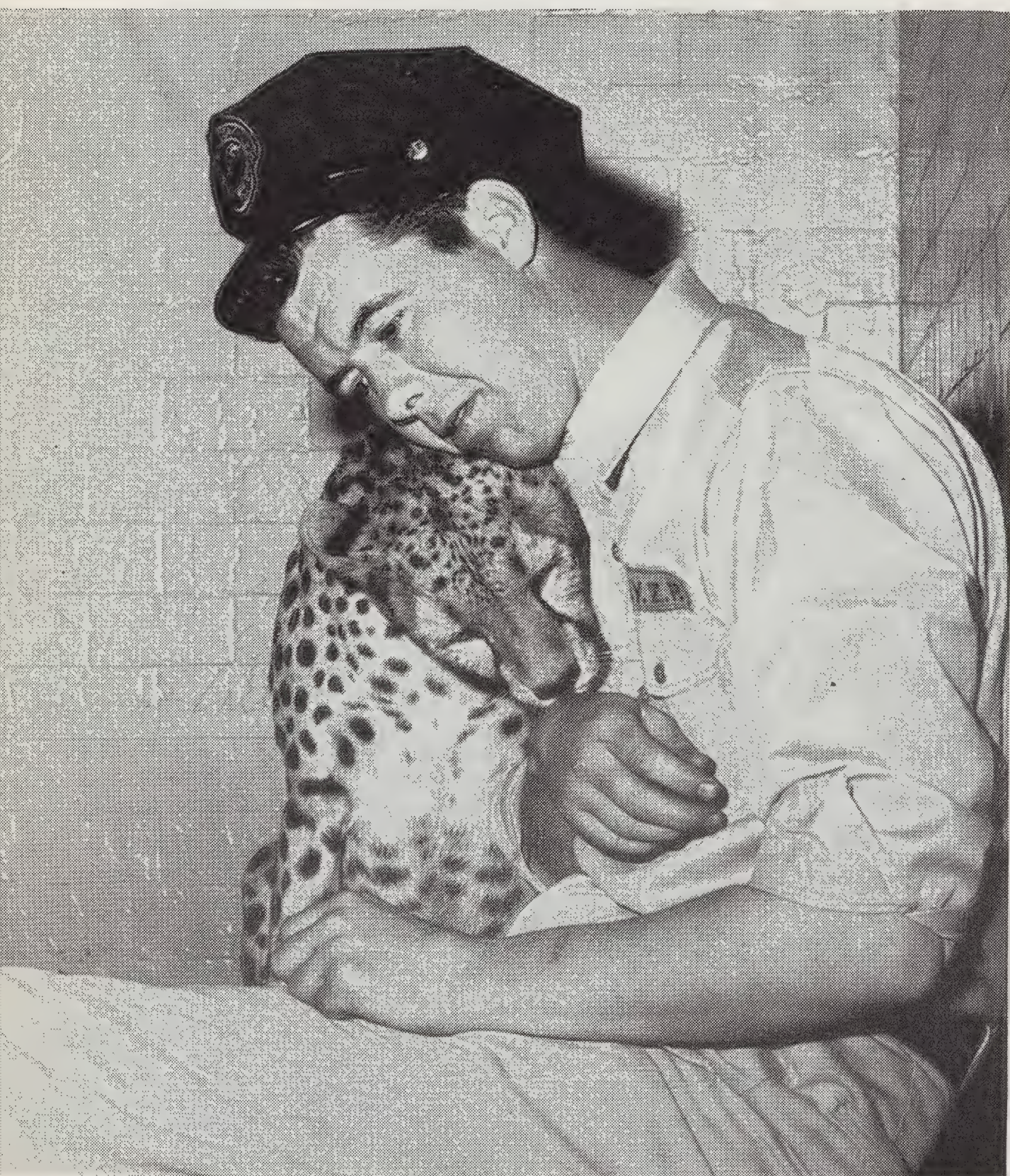
Photographs by SAM FALK
New York Times

For many years Sam Falk has been considered one of the best photographers on the staff of the *New York Times* and the *Times Magazine*. While he never specialized in animals particularly, he has occasionally been a welcome visitor to the Bronx Zoo and recently he drew an assignment from the *Times Magazine* to photograph ten animals which President Osborn selected as especially interesting to the public. Good photographer that he is, Mr. Falk gave his office full measure: he also photographed some of our keepers with *their* favorites — which are not necessarily the public's. His camera studies are reproduced on this and the next four pages, and tell better than words the kind of relationship that exists between good keepers and their animals. *Below:* **JOHN CURRAN'S** favorite is friendly "Bambi," a **WHITE-TAILED DEER** that learned to like people while a resident in the Children's Zoo.





Keeper **ALBERT LANNON** of the Reptile House has no very good reason to be fond of such a normally undemonstrative creature as a **GALAPAGOS LAND IGUANA** except that this one (named Charlie) has responded so well to his keepers' quiet, slow and persistent advances. When Charlie arrived a few months ago he was constantly on the aggressive; now he is quite willing to sit on a lap and have his head scratched.



Keeper **CHARLES PILEGARD** is not a particularly *old* friend of "Bella," the young **CHEETAH**, but Bella is not one to quibble — she likes any of her keepers willing to stop and play with her.

Keeper **MICHAEL QUINN** and **OKA**, our big female **GORILLA**, virtually grew up together in the Bronx Zoo, and their friendship is on a completely relaxed basis. Quinn calls her "Doll" and brings her delicacies from his own table; Oka responds by accepting him as a playmate, and sometimes even obeying him.





Every morning when keeper **RICHARD BERGMANN** of the Small Mammal House approaches the **GIANT OTTER**, it begins whining, snuffling and making all sorts of sounds that indicate affectionate eagerness to play. Bergmann usually stops to play for a few minutes. As he says, you can't resist an animal that likes you so much.



Keeper **RAY CUMMINS** of the Reptile House chooses the **COLOMBIAN GIANT TOAD** as his favorite because "It's the biggest toad in the New World, a real giant, but nobody pays much attention to it — it's just a toad!"





Keeper **JOSEPH NEGLIA** lets this young **AARD-VARK** "chew" on his thumb to demonstrate its friendliness. It's quite safe, for Aard-varks have only cheek teeth. They take food — ants and termites — with the sticky tongue.

"This **GENTOO PENGUIN** is named Tracy and he gives me more trouble than all the others put together, because he's always pestering around underfoot," keeper **SALVATORE SOLANTO** of the Penguin House explained. "That's why I kind of like him most, I suppose."

Some months ago former Head Keeper of Birds George Scott brought a **BRAZILIAN TURKEY VULTURE** back from Venezuela — an appealing youngster still in downy plumage. Since then it has been keeper **JAMES BARDSLEY'S** pride and joy. "Who else," he remarked recently, "is going to like it if I don't?"



Oilbird-watching in Caves

THIRTY-TWO YEARS AGO this spring the Bronx Zoo exhibited its first and only Oilbird for a brief two weeks. Gloria Hollister, then of the Department of Tropical Research staff, had captured the bird in the Spring Hill estate cave described in Dr. Snow's article on page 117, and managed to keep it alive on the voyage to New York by feeding it on fresh coconut — which she had to chew up first. Even before that spring of 1926 the Department had made some studies of Oilbirds, as Dr. Beebe's reminiscent article indicates. Now that the Department has its base in Trinidad, and Dr. Snow on its staff, the Resident Naturalist is undertaking a prolonged investigation of these fascinating "troglodytes of the bird world."

All Photos by Dr. Wilbur G. Downs

THE GUACHAROS OF CARIBE

By William Beebe

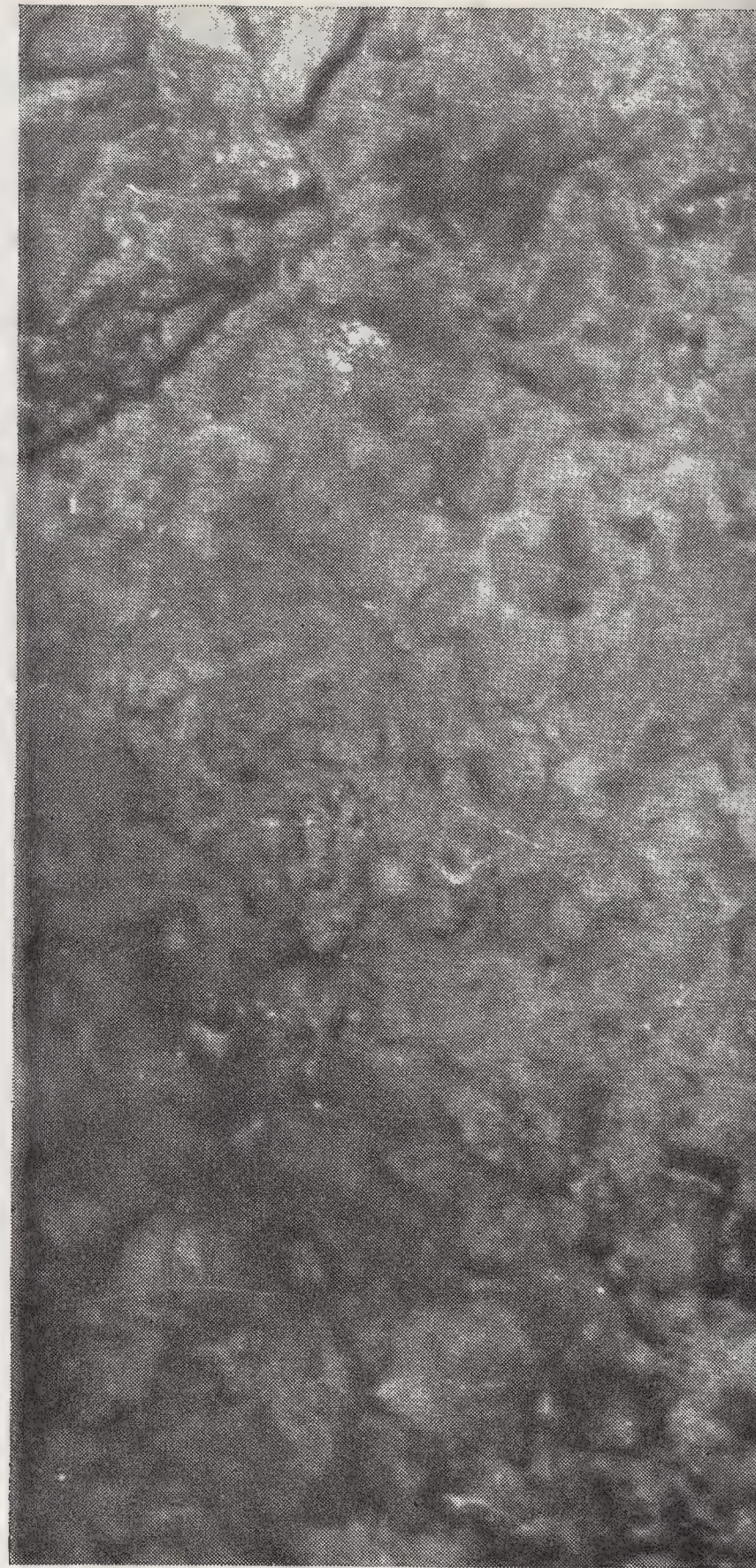
*Director Emeritus, Department
of Tropical Research*

NEARLY ONE HUNDRED AND FIFTY YEARS AGO Alexander von Humboldt discovered a great cave in northeastern Venezuela, shot one of the strangest birds in the world and later named it *Steatornis caripensis*. This is what we now call the Guacharo or Oilbird, of rich orange-rufous speckled with white, with a stout beak hooked like a hawk's, and a mass of stiff bristles extending forward from the head. It has a wing-spread of more than three feet. In structure it is so peculiar that it has a genus, family and even a sub-order of its own. Its closest relatives are the nighthawks and whippoorwills but its food consists not of insects, but of the fruit of palms and other trees. Finally it is the only bird in the world which nests and spends its entire day in the darkness of caverns.

Humboldt's name means the Tallow or Oilbird of Caribe, that being the nearest village. Oilbird refers to the amount of fat which ensheaths the nestling and whose edibility is the greatest threat to existence of these birds. The Spanish word *guácharo* has nestling as one of its meanings.

Late in March, several years ago, I left Caripito to visit this famous cave. We travelled by car, then on muleback and finally on foot, reaching the cave in five hours. Our route led through diversified country varying from lush jungle with hummingbirds and macaws, to semi-arid cactus-dotted expanses marked by Vermilion Flycatchers and Ground Doves.

The entrance to the cave is a great jagged hole in the side of an enormous, precipitous cliff, the rock showing gray, pink and yellowish. On the left as you approach rises the opposite cliff, equally steep and so directly opposite that it seems as if an entire slice of the mountain had been shorn away. There is a curious depression opposite the cave mouth as if the cave once extended





clear across and perhaps still continues beneath the external veneer of rock. The entrance is shaded by several tall, scarlet immortal trees all solidly draped with waving moss.

Parakeets screeched past by the hundred, divided into pairs which merged with the flock, but always separated again. In the very entrance were three tall wooden crosses, the central one largest. Bunches of roses, old and faded, were tied to the crosses. As we dismounted, six men came out, Basque priests from their accent. Two were clad in bathing trunks and all were smeared with black mud on body, limbs and face, and they donned white surplices at the entrance. One had a cluster of small, black-backed cave rats.

A very definite breeze blew out of the cave, cold on our heated faces. A hundred yards inside our breath became visible as a mist. As we waited, a glowing blue morpho butterfly and later a second fluttered past out of the sunshine and warmth into the cave, high up among a maze of stalactites and on out of sight. They did not return. One

An adult Gaucharo, or Oilbird, in full flight just under the roof of the cave in Trinidad. It is a big bird to maneuver in a cave that is sometimes restricted; wingspread is 3 ft.

could think of these as flying in as beautiful butterflies and, changing into Oilbirds, flying out at night. Dracula stuff.

Looking in from outside, huge stalactites could be seen, and within the entrance there seemed to be winding, ascending stairways on each side, with balustrades of stalactites and stalagmites. The larger ones, near the outer air, had small festoons of ferns growing on them, but no other vegetation was visible. One hundred yards inside a weird sound became audible, more of a snarling than anything; the unceasing calling of the Oilbirds from high overhead. We had powerful headlights with batteries and these gave light enough to see the birds on their ledge nests and when they flew owl-like over our heads. The sound of the birds was a screeching snarl, together



with an undercurrent as of a hundred typewriters clicking ceaselessly. It has been established that (as in bats) it is by the sonar functioning of these clicks and snaps that these birds orient themselves in flight in the absolute darkness of their subterranean home, and in their nocturnal search for the seeds of palms. The snarling had a liquidity which was inimitable. There was something sinister about the uproar in common with the roaring of Howling Monkeys. It was wholly unbirdlike, but not inappropriate when emanating from these mysterious creatures, whose home was an underground cavern, whose day consisted of a scant hour or two of dusk and dawn out of the twenty-four.

It is difficult to imagine a greater contrast in bird voices than that between the crisp *Whip-poorwill* or the sharp, distinct *Whoareyou* of the Nighthawk and the raucous vocal turbulence of the Oilbirds.

Even if we could not have seen or heard the birds their haunts were definitely demarcated by windrows of nuts and seeds, almost a pure culture

of fruit of the Turu Palm (*Jessenia oligocarpa*), looking like nutmegs with striped, fibrous outer coat. At considerable distances the birds search for these at night, return, digest the thin, outer, fleshy coat and regurgitate the seeds which fall to the floor of the cave. The entire floor was covered with rows of dead and dying, sprouted stalks, 12 or 18 inches tall, spindly and bleached white. By searching I discovered two small, white palm fronds, and a single oval leaf which had found some means of fashioning themselves without chlorophyll. It was the most desolate expanse of vegetation I have ever seen.

The most evident sign of life, as we flashed the lights about the ghostly forest, was hundreds of crickets which leaped in all directions. They were pale brown and of many sizes, big ones with tremendously long antennae, and tiny leapers which looked like out-sized fleas. Large numbers were resting on the lower part of the walls and stalagmites. Fluttering from stalk to stalk were small white moths, and under stones we found whip scorpions, showing little pigmental reduction.

ghostly forest of light-starved seedlings sprouted from seeds regurgitated by the Oilbirds is a common occurrence in caves inhabited by these birds. Rarely is there light enough for them to reach any size.

And all the time there came from overhead the harassing snarls, mingled with baby bird complaining which we knew were not baby birds, and croaks which recalled real crows.

We went on and on, clambering over gigantic boulders or creeping between monoliths. The Oilbird chorus died down and the darkness seemed denser than before. Then a noise sounded softly in the distance and we entered another cathedral of howling devils snarling and flapping against the lofty ceiling. More seeds and more hopeless sprouts. Then we slid through a narrow, oblique, tight-fitting slope, a fat man's misery, floored with black soppy mud a foot in depth, and we slithered over smooth rocks so that all our clothing was matted and black. And always we marvelled because the chambers were air-conditioned, the air pure and cold, and a third mighty room with a third colony of Oilbirds was approached and passed.

The next narrow corridor led down into a shallow stream, with tinkling rapids and a midget waterfall—the only sounds except the birds which the cave permitted. We waded in this for a hundred yards and then I caught sight of a white fish swimming over the sandy gravel. I had my net in readiness and a scoop gathered him in. Again and again this happened and with ten scoops I secured nine fish. In the hand they showed as pinkish-white with minute black dots for eyes. They made no effort to avoid the net, being apparently quite blind. The six short barbels and wide mouth identified them as catfish.

We passed from one lofty chamber to another, the connection being usually through narrow funnels. The lime formations were very beautiful and of great variety. In one smaller room were thousands of small points of lime, in another immensely long curtains or portières hung down, the folding being as delicate and intricate as lace or silk. In one place twenty or more stalactites hung close together like organ pipes and one of us played on them with the handle of the net.

On our return trip the first view of the entrance was sheer luminosity, the three crosses, tiny by

distance, set in a delicate mist of greenery on the opposite cliff.

The birds were said to leave the cave around six o'clock but at six-thirty, from outside on mule-back, I could hear them getting nearer and nearer, now loud, now very low. They reached the outermost lofty chamber and fluttered near the entrance before the first bird actually swung out. As I left all began to appear, silent and owl-like. Those which emerge first are said to return and allow their mates to take their turn, but this is hearsay.

As my mule trotted along the trail I heard a single last snarl from the darkness overhead.

TRINIDAD'S OILBIRDS ARE YIELDING NEW FACTS

By David Snow

Resident Naturalist, Simla

SOON AFTER MY ARRIVAL at the station of the Department of Tropical Research at Simla in March, 1957, I visited the Oilbird colony on the Spring Hill estate at the head of the Arima Valley. With a ladder I got up to six of the nests and found that one nest contained one absolutely clean egg; the breeding season was just beginning. Since then I have devoted a good deal of time to the Oilbirds and have paid regular visits to this cave and less frequent visits to other caves. This is an interim report on a study which is still continuing.

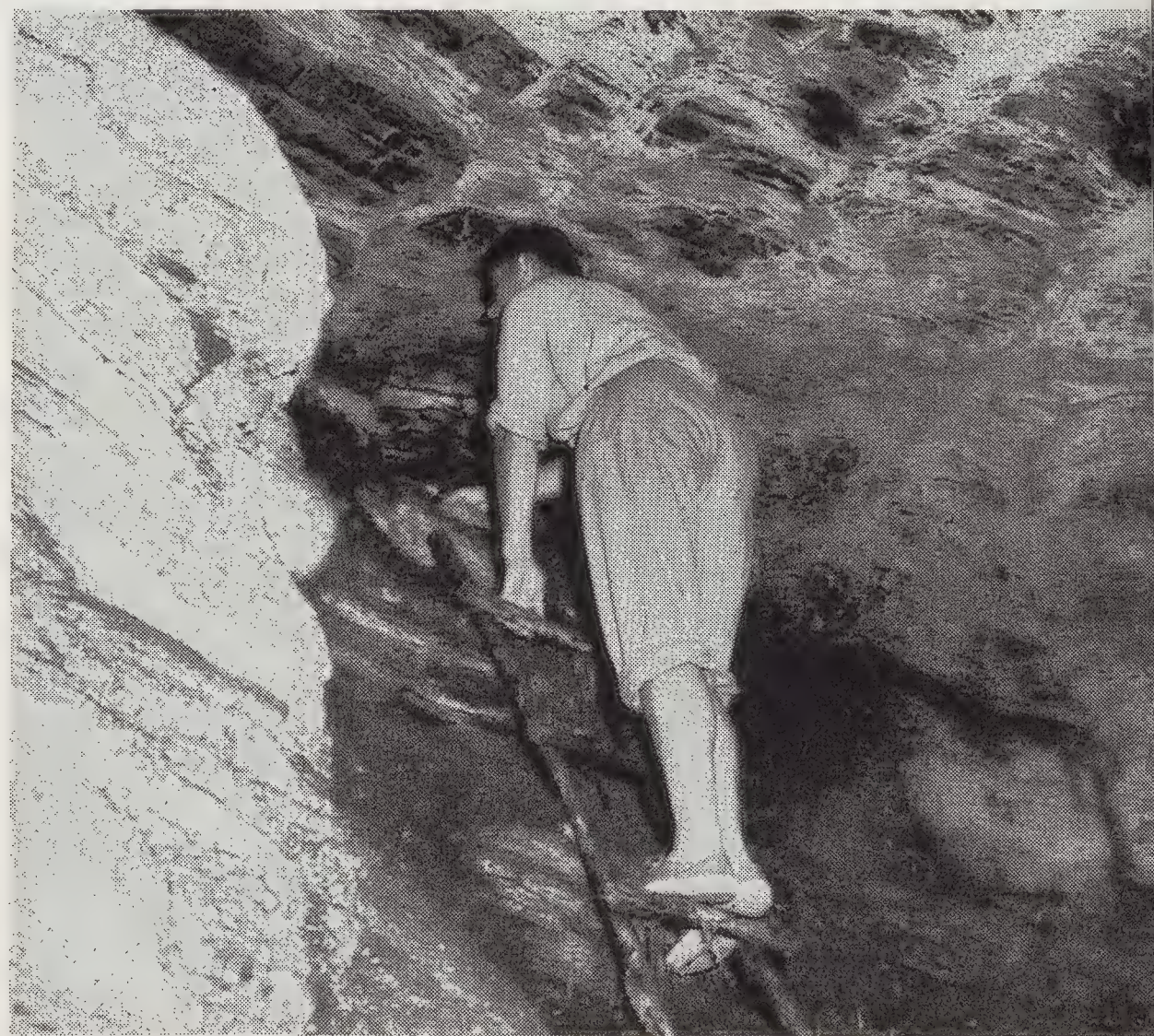
The Spring Hill colony is particularly well suited for study. The birds live, not in a dark cave as most Oilbirds do, but in a deep gorge down which flows a small stream. The gorge is roofed over in places but for the most part is open to the sky, and in the middle of the day the sunlight, entering vertically, illuminates most of the interior. Moreover the nests are placed on ledges only 15 feet, or less, above the stream bed and can easily be reached by ladder.

There has been no precise information hitherto on the breeding season of the Oilbird. In most caves it is very difficult to ascertain the contents of the nests, and in any case a single visit in a season, on which previous statements have been



Entrance to the Oilbird Cave on the Spring Hill estate is a picturesque cleft in the rock wall, through which a small stream rushes. Dim light filters into the cave from breaks in the roof.

based, cannot yield the required information. However, most writers have agreed that breeding must start in the early months of the year, while Cherrie alone (*Sci. Bull., Mus. Brooklyn Inst.*, 1, 1908, p. 368) states that there is a second breeding season in the autumn. My observations so far have shown considerable irregularity in times of breeding and it is clear that records extending over two or three years will be needed before generalizations can be made. Of the eleven pairs which nested in 1957, four laid their eggs in March, five in April, one at the beginning of May and one in July. Two of them lost their eggs and made second attempts (in May and July); two more pairs lost their eggs or young but made no second attempt that year. Altogether eight pairs reared young successfully. After raising their first brood two pairs started again, in August and September, but the others did nothing further and from the abundance of feathers which were dropped below the nests it was evident that many birds were moulting. Then, quite



Dr. Snow investigates six nests in the Spring Hill cave. Most of them were easy to reach by ladder from the bed of the stream in the cave.

Both eggs and a very young bird are visible on this ledge — as well as a number of colorless seedlings that have sprouted in the shallow dirt.

unexpectedly, in December four pairs laid again, and a fifth followed in early January, 1958. It looked as if another main breeding season was starting, but all except one of the five lost their eggs or young and it was not until March that most of the pairs began to nest, approximately the same time as last year.

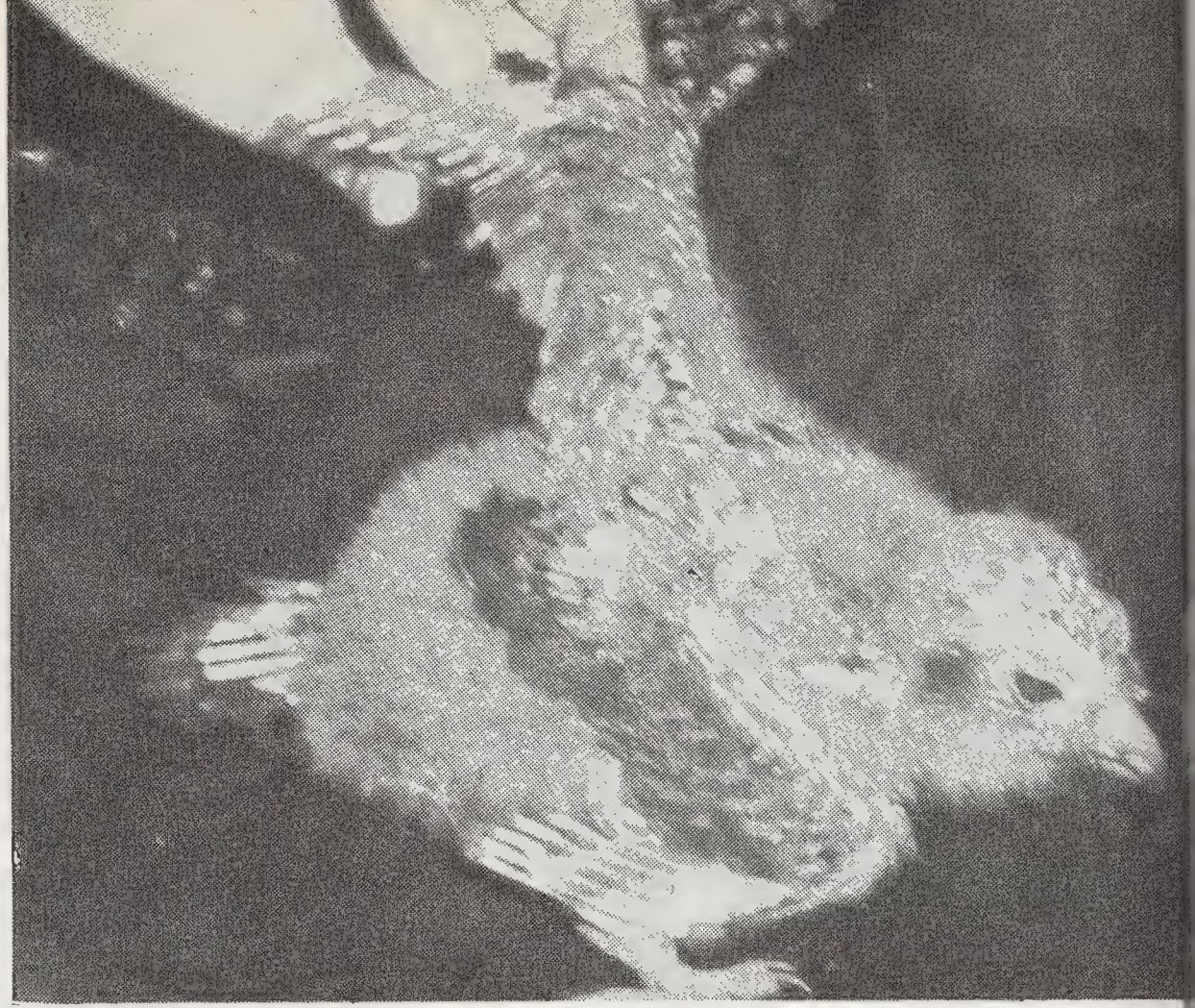
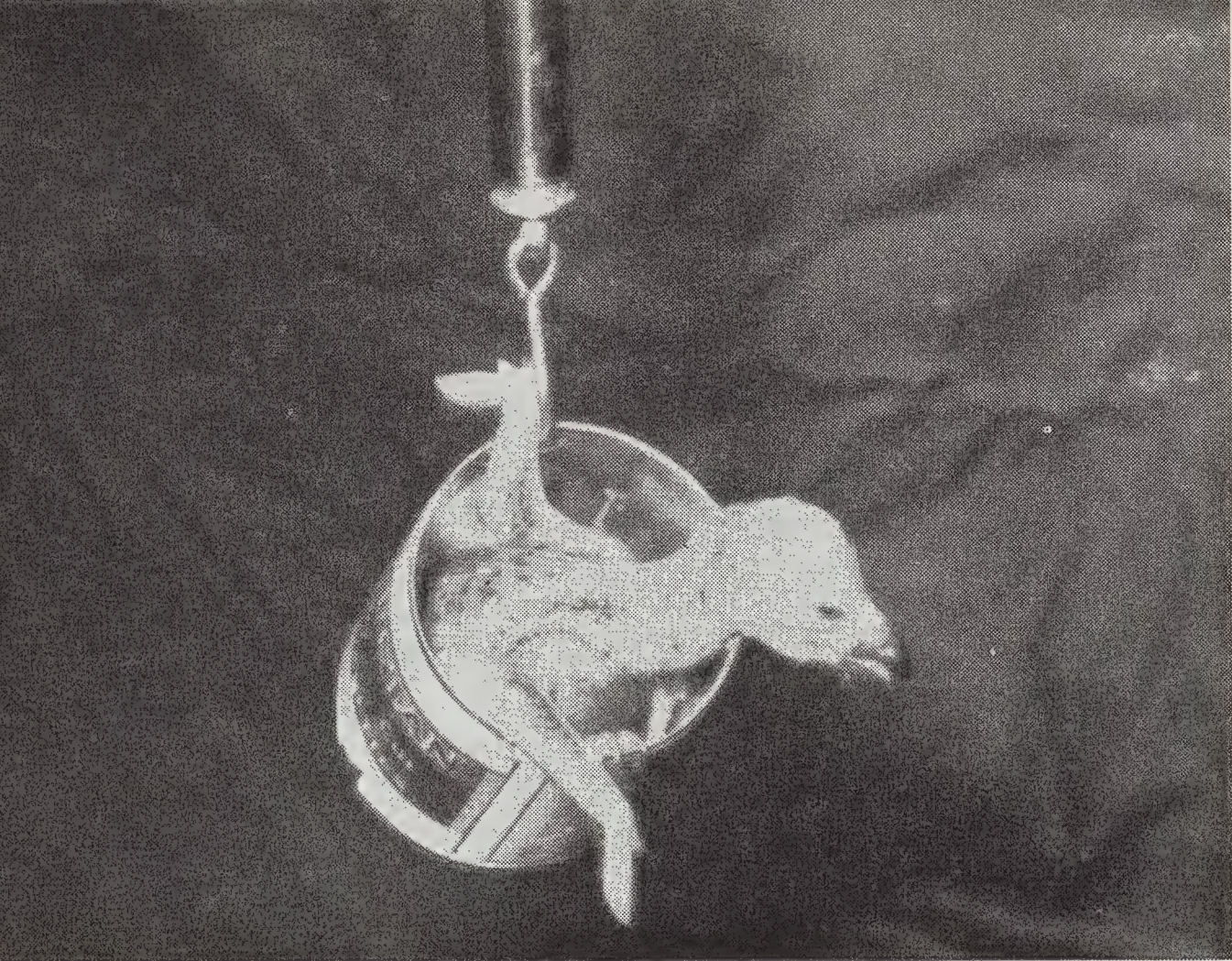
The whole tempo of nesting is very slow. To begin with, there are unusually long intervals between the laying of successive eggs, anything up to nine days but most often about four or five days. The birds must incubate pretty regularly from the time the first egg is laid because the eggs hatch in the order in which they are laid and at about the same intervals. The incubation period is about 33 days.

When first hatched the young bird is naked except for some short sparse down on the under side. At the age of about a week the rudiments of a second set of down feathers appear as dark points beneath the skin, on both upper and lower surface. A week later these rudiments are conspicuous black streaks under the skin. At the age of about three and a half weeks this second generation of down feathers bursts out, and for the

next month the young bird is clad mainly in gray down. The next plumage that grows and gradually replaces the down is of adult type; there is no distinct juvenile plumage.

A great deposit of fat is laid down by the growing Oilbird and it is this that has led to their exploitation by the natives of Venezuela and Trinidad. At hatching they weigh about $\frac{1}{2}$ ounce. They increase rather slowly in weight for the first week, then more quickly, until at the age of about 70 days they weigh as much as 23 ounces, a large part of which is fat. Then for the next 30 or 40 days they lose weight, reaching about 14 ounces, by which time their wings have reached full length and they are able to fly. The total nestling period, from hatching to flying, has been rather variable in different nests, ranging from about 95 days to 120. I think that the differences may partly have been due to different food, a topic which I shall discuss later. The very long period of development, longer than in any other land bird of comparable size, may be an adaptation to the very specialized fruit diet on which the birds feed both themselves and their young. This diet is probably very poor in proteins





Young Oilbirds in various stages of development. At the upper left a 21-day-old nestling is weighed. A considerable part of the weight during the first 70 days is fat. Upper right: a nestling at 50 days. At lower right: 61 days old, but not yet able to fly.

and may not permit a faster development, but this is a problem which I have not yet studied.

Soon after starting to observe the Spring Hill colony I fixed two catching trays below the nests, at points where the conformation of the cliff channels the falling seeds which the birds regurgitate as they sit on the nests. As Dr. Beebe has explained in the previous article, Oilbirds leave their caves at night and bring back large quantities of fruit which they digest during the day. With very few exceptions these fruits are of the same general type — they are more or less fleshy and contain a single relatively large, hard seed. Only the fleshy pericarp is digested, the seed being regurgitated. It has generally been stated that palm fruits are the Oilbird's main food, but one or two previous accounts mention the fruit of "laurels" (Lauraceae) and other trees. My collections from the catching trays, now totaling over 40,000 seeds, have shown that palm fruits are an important and constant part of the diet but that fruits from other trees have a prominent place and may for weeks on end easily outnumber the palms. Among the non-palms, the Lauraceae are the chief family, but a tree locally called "Incense" (probably *Protium* sp., but as yet unidentified) is very important, its seeds having outnumbered all the others for a period of several weeks this year. It was during the period when Incense fruit was dominant in the food that



the young developed in as little as 95 days. The fruit of the two most important palms, *Jessenia oligocarpa* and *Euterpe* sp., have been present in all my samples in every month of the year and may be considered as the staple items of diet, but the Lauraceae and other non-palms, as well as the palm *Bactris cuesa*, are highly seasonal. Some of the fruits taken have been surprising. I sometimes find in my catching trays small numbers of the seeds of the palm *Geonoma vaga*, a small tree not usually more than 15 feet high that grows in the undergrowth of dark forest and bears fruit about a quarter of an inch long, consisting mainly of a hard seed covered by a very thin pericarp. One would have thought that an Oilbird would not find it easy to collect such fruit and certainly that it would not be worth its while. I also find

small numbers of the fruit of an introduced palm, *Livingstonia chinensis*, to obtain which the birds must fly at least to Arima, six miles away. Another introduced fruit which is taken in small numbers is that of the Pewa palm (*Bactris utilis*): only the infertile seedless fruits are taken, the fertile ones being apparently too bulky for the birds to manage.

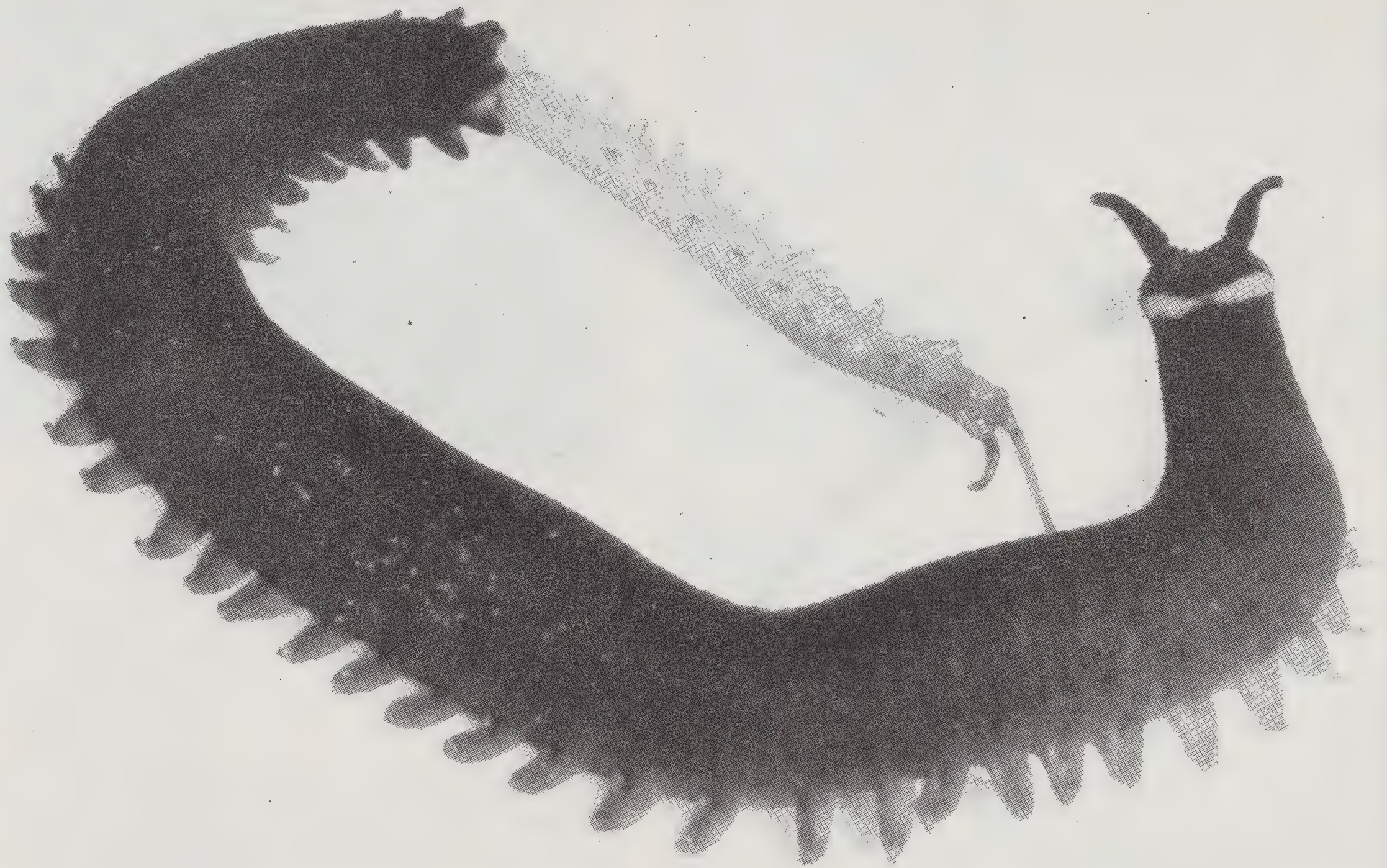
I have not yet found out how much food is brought back nightly by each bird, but the following figures are worth quoting. Two nearly full-grown young birds, which fell from their nests during a visit to a sea cave on the north coast of Trinidad and were taken back to Simla before being successfully introduced into the Spring Hill colony, between them regurgitated 27 seeds of *Bactris cuesa* and 18 of *Euterpe* sp., obviously part of the previous night's feed, representing a total weight before digestion of about $3\frac{3}{4}$ ounces. One evening I collected all the seeds off one nest which was occupied by a pair of adults without eggs or young, and next day collected from the same nest 118 fresh seeds of four species, representing a total weight before digestion of about $6\frac{3}{4}$ ounces. This is a minimum figure, since although this pair of birds were tending to eject their seeds onto their nest more than the others, they must certainly have let some fall over the nest edge.

Owing to the conditions of nearly total darkness in which most Oilbirds live, little has been found out about their behavior at the nest. The comparative lightness of the Spring Hill cave is here a tremendous advantage, which I am now trying to exploit. In December last year, with the help of Mr. John Dunston, a keen local naturalist, I fixed up a platform spanning the gorge at a height of about twelve feet above the stream bed and a few feet upstream of the nest-ledges, and on it I placed a small canvas blind. This has enabled me to observe the Oilbirds on their nests from their own level and at a distance of only a few yards. The birds have now become remarkably tame, and though some leave their nests when I enter the hide they are nearly all back again within a few minutes. There is no longer much of the screaming and snarling which one hears continually from birds disturbed in other caves.

Both members of the pair incubate the eggs,

and I have several times seen the "change-over," which takes place with no ceremony. The incubating bird gets up and shuffles off the eggs and the other then shuffles on and settles down. The two birds then remain crouching side by side, the incubating bird being a little lower down than the other. Like other cliff-nesting birds, when they defecate they turn until their tail points outwards and eject the faeces clear of the nest. I have occasionally seen birds repairing their nests by plastering regurgitated matter with the side of the beak round the outer edge of the nest. Sometimes birds on adjacent nests engage in tussles which may last several minutes, locking their beaks together and twisting their heads from side to side, squawking hoarsely, and causing considerable excitement among the other birds. Most of the time, however, they sit quietly, occasionally regurgitating seeds, sometimes apparently asleep. Pairs sitting side by side preen each other's heads; the rest of the plumage they preen for themselves. When they scratch their heads they bring the foot up directly, under the wing. So far I have not seen the young being fed, although I have spent a good many hours watching for it, and I suspect that it takes place very early in the morning soon after the old birds return from foraging. This and many other aspects of their behavior remain to be investigated.

The size of the Spring Hill colony has fluctuated markedly in recent years. In 1950, following raids by local people, the site was apparently deserted, but by 1955 there was again a flourishing colony and Dr. Beebe counted about 40 birds in April of that year. In 1957 11 pairs nested, and this year there are 13 nesting pairs and a few other apparently unestablished adults. Doubts have been expressed about the Oilbird's survival in Trinidad. Although they are protected by law, some poaching continues and persistent raids can easily lead to the extermination of small colonies. However, the remoteness of some of the big caves in the mountains, and the inaccessibility of the sea caves, should ensure that part at least of the population will remain little disturbed, while even in the caves which are much visited by poachers there are many high ledges that are unreachable. As long as forest remains on the Northern Range of Trinidad the Oilbirds should be safe.



Peripatus: Fierce Little Giant

By ANNE J. ALEXANDER

Department of Zoology, Rhodes University, Grahamstown, South Africa

Many of the observations described in this article were made during a visit to the station of the Department of Tropical Research of the New York Zoological Society at Simla, in Trinidad, B. W. I. This visit was made possible by the generosity of the New York Zoological Society and the South African Council for Scientific and Industrial Research, to whom I would like to express my thanks.

THE ANIMALS belonging to the Phylum Onychophora are not sufficiently widely known to have what could be described as a "common name." *Peripatus* is really the name of what used to be the largest genus within the phylum, but "Peripatus" is gradually becoming accepted as laboratory slang for all or any onychophorans—and this is the name that they will be given throughout this article.

The *Peripatus* are usually placed fairly close to

the Phylum Arthropoda to which all the invertebrates with jointed legs belong, such animals as the insects, centipedes, scorpions and crayfish. They, *Peripatus*, are small animals, normally about two inches long, though there is in Trinidad a giant among the group, *Macroperipatus*, which may be as much as six inches long. The legs of *Peripatus*, of which there are a large number, from fourteen to forty-one pairs, are not jointed yet they have two claws on each foot, as do so many of the arthropods. Color varies from species to species and, in fact, within any one species. Although in general they are dark colored, there is an attractive South African animal which is bright orange with sometimes a black head and legs, while the large Trinidadian *Peripatus* is a startling purplish color with brilliant

canary yellow stripes above each eye or across the back of its head. Their skin is soft and dry and, in most cases, covered with minute sensory papillae which give it a velvety quality.

The geographical distribution of *Peripatus* is entirely within the tropics and Southern Hemisphere, as can be seen from the map. This limited distribution does in part explain why they are so little known, the other contributing factor being their restricted microhabitat. In general they live only in fairly moist places, in rotting wood or under stones in forested areas.

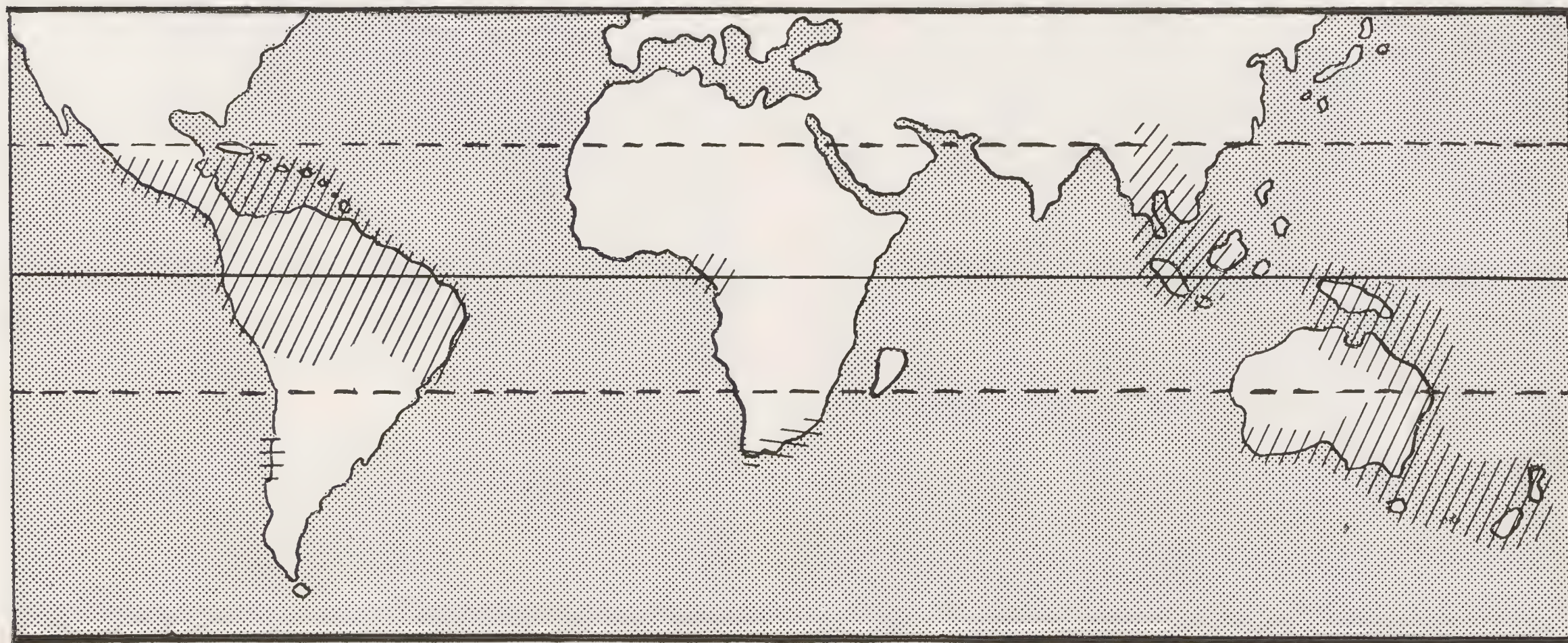
This restriction of habitat appears to depend on the animal's inability to conserve water within its body. The rate of water loss through the skin is high, largely, no doubt, because of the many unprotected respiratory openings which occur over the surface of the body. The obvious way to

cated and then placed on filter paper moistened with some harmless dye will take up the moisture from below it, for the dye will be found within the sacs. Furthermore, where it is possible to watch the ventral surface of one of these "thirsty" *Peripatus*, it is easy to see that the sacs are everted only in that region of the body directly in contact with the moisture. Many *Peripatus* have, then, two ways of drinking, either by way of their mouths or their eversible sacs. But, while mouth-drinking is restricted to water in surface droplets or little puddles, the eversible sacs have the advantage that they can be used to draw up water from fine cracks and crevices in the soil or wood.

Another way in which *Peripatus* limits its water deficit is by avoiding exposure to the heat of the day, for this would increase evaporation of water from the respiratory openings. They have in fact a well-marked rhythm of nocturnal activity, as can be very easily witnessed in the laboratory. This activity seems, at least in one of the South African animals, to be "built-in" to the extent that it persists in total and continual dark-

Left: The birth of a baby giant *Peripatus*. There may be twins, or only a single baby, about a third the length of the mother. Below: *Peripatus* has a worldwide but highly irregular and spotty distribution.

*Photograph by M. Woodbridge Williams,
Copyright, National Geographic Society*



make good this loss is by drinking — and *Peripatus* can and does drink free water when it is accessible, drawing it up into the mouth apparently by suction. This, however, is not the only way in which the animal can take up water: in some species, including both of those found at Simla, they can absorb water even when they cannot reach it with their mouths. This is done by means of small thin-walled sacs which can be everted from the bases of the legs. It can easily be shown that a *Peripatus* which has been desic-

ness and is independent of temperature variations. Until a recent observation on the giant *Peripatus* at Simla, an account of which will be given later in this article, there was no evidence that this nocturnal activity occurs in natural conditions. It had been shown in the laboratory but, despite long hours of hunting in the forests, nobody had ever seen even a single *Peripatus* coming out from its leaf or wood cover and walking about, either by day or night. Laboratory experiments had, however, suggested that even in pitch

darkness the animals are more inclined to walk just underneath the leaf cover than above it. This sort of behavior in which the animal seeks to keep as close a physical contact as possible with solid objects in the environment is known in other animals; it is called "thigmotaxis" and, in this case, considerably reduces one's chance of noticing a *Peripatus* by torch light at night.

The animals look such soft inoffensive creatures that one might expect them to have no protective mechanism other than their somewhat cryptic colors and habit of staying absolutely still when disturbed. However they do have a weapon of defense, consisting of a pair of very extensive "slime glands" within the body and two stubby papillae on either side of the mouth. From these latter a shot of slimy fluid can be ejected with surprising accuracy and may travel a distance of as much as 18 inches. This fluid solidifies rapidly on contact with the air and becomes very sticky. Though experiments indicate that it has no poisonous properties, it does effectively ensnare the small arthropod enemies against which it is usually used, so that *Peripatus* gets a good chance to escape.

When *Peripatus* was initially discovered it was thought to be closely related to the slugs and was in fact given the name of *Limax*, that of a genus of slugs. It is thus not surprising that it was thought that *Peripatus* fed on vegetable matter. Later it was stated that the animals lived on the flesh of other arthropods, insects in particular and, in spite of its harmless looking appearance, one of the early naturalists illustrates a *Peripatus* "rampant," shooting slime at its prey. Although this sounds perfectly reasonable, the scientists who later studied *Peripatus* concluded that it lives mainly on the microfauna — that it catches little insects using its small but spiky jaws. True, *Peripatus* will eat crickets in the laboratory, but it was considered that this was possible only because the insects were already dead when offered as food. However my observations on *Peripatus* in South Africa have shown that they can and will spit at arthropods which they could not hold but for the use of the slime; once ensnared, the *Peripatus* will advance upon the insects and eat them.

It was therefore of great interest to discover that both of the Trinidadian *Peripatus* also spit

at their prey when it is large and active enough to warrant such behavior. Frequently the *Peripatus* will fold back its antennae as it goes in to begin feeding on the struggling insect which has just been entangled. Dr. William Beebe, watching one such attack by a giant *Peripatus* upon a cricket at Simla, remarked "That *Peripatus* looks so fierce that I expect to hear it snarl at any moment."

Nevertheless, there was still no evidence that offensive spitting also occurs in natural conditions. As has already been pointed out, it was asking a lot from luck to expect to find a *Peripatus* at all at night, but to hope to find one which was eating its freshly caught prey really seemed wildly over-optimistic. However, at about half past eleven one February night, as I was walking along one of the traces in the Simla jungle looking for insects to feed my scorpions, the beam of the torch showed up the shiny high-lights on a cricket's skin. When I knelt down to catch the cricket, I found that a giant *Peripatus* had got there before me — she was standing beside the insect and slowly eating her way into its body. What was even more interesting was that the cricket's body was covered with fresh slime, so much so that it partly stuck to a nutmeg kernel

There are two species of Peripatus in Trinidad and this is the smaller form, only about two inches in length. We have occasionally exhibited this curious creature, but it prefers to remain hidden by day.

that lay beside it. With the *Peripatus*, the cricket and the nutmeg I rushed back the couple of miles or so to the laboratory. As soon as the *Peripatus* was left in peace in a dish she went back immediately to eating her cricket. Her phlegmatic behavior was in no wise reflected in her observer for, in a single lucky observation, I had obtained good evidence not only for natural nocturnal activity but also of *Peripatus* feeding on relatively large insects which it traps in its slime.

The reproductive biology of *Peripatus* is in some ways just as strange and interesting as their behavior. Although some of the Australian species do lay eggs, the rest give birth to living young, sometimes one at a time, but sometimes twins and sometimes as many as ten babies at once. The giant *Peripatus* of Trinidad gives birth to

either a single baby or twins; in either case they are about one-third as long as the mother — that is, relatively enormous as babies. The mother does not seem to pay any attention to the young during their birth and afterwards even to recognize them. One possible exception to this is a South American animal which, it appears, may normally carry the newly born young on her back for some time.

Nobody yet knows how long a *Peripatus* can live. Dr. Manton of Kings College, London, kept them up to six years in captivity and considers it unlikely that the species with which she was dealing live more than a few years beyond this age. It is known that they gradually darken from an attractive baby-pink to their final color



as they grow older and that, even after they are mature, they shed their skins fairly often — about once a fortnight. The split in the skin starts over the head and then extends along the middle of the back. Although the hard covering of the jaws is shed with the rest of the skin, this does not prevent the newly moulted *Peripatus* from turning round and eating its old skin, sometimes starting before it is entirely free from the body.

In only one species have animals been reared to maturity in captivity; these appeared to mate at about a year old. The actual details of fertilization are known for only one of the two families and in this, the *Peripatopsidae*, the procedure is very extraordinary. The male deposits spermatophores, little packages enclosing sperm, anywhere on the body of the female; then, at the point of

contact between the spermatophore and the body, the wall of the spermatophore and the skin of the female begin to disintegrate. As a result, the sperm are liberated into the body cavity of the female. Eventually they pass into the genital ducts and fertilize the eggs while the empty spermatophore shrivels and is cast off with the next moult. In the other family, the *Peripatidae*, we have no information about the process but it seems possible that it is not the same as in the *Peripatopsidae*. In the giant *Peripatus* of Trinidad, which is one of the *Peripatidae*, there were no signs of any spermatophores being stuck onto the females during the time that they were under observation at Simla. There are, moreover, reports that entire spermatophores have been found within the genital ducts of females of this family. The spermatophores are much larger than those of the *Peripatopsidae* and it is possible that in the *Peripatidae* some more orthodox type of mating occurs.

This is but one of the large number of problems about *Peripatus* which still await solution. This animal was once thought to be the “missing link” between two great invertebrate groups, the annelids, containing the familiar earthworms and the leeches, and the arthropods, comprising the insects, centipedes, scorpions and so on. *Peripatus* has further aspired to the title of “living fossil” because animals which were clearly “*Peripatus*” had been described from the middle and even the lower Cambrian, nearly 500,000,000 years ago. With added information about the subject we have tended to modify our views about the importance of *Peripatus* as a “missing link” and most authorities nowadays would only say tentatively that “a peripatus-like animal may have stood somewhere near the base of the arthropod evolutionary tree.” Moreover other, bigger or more recently discovered “living fossils,” such as the coelacanth and the mollusc, *Neopilina*, have outshone the little *Peripatus*. Yet, without these romantic-sounding titles, *Peripatus* is still as fascinating to the zoologist as ever. There is still much that we have to learn of these creatures and we may be led by future discoveries about their biology, behavior and physiology to a clearer understanding of that “higher” and more “completely studied” group, the Arthropoda.

News from the Conservation Foundation

New Publications

Three books have been published by the Conservation Foundation since the last issue of *ANIMAL KINGDOM*. One is *The Law of Water Allocation in the Eastern United States*, edited by David Haber and Stephen W. Bergen, which presents the papers and proceedings of a symposium in Washington, D. C., in October, 1956. We understand that much of the thinking developed at this symposium has influenced significant water programs and their legal interpretation in a number of states. The second book is *Living Resources of the Sea* by Lionel A. Walford. This volume is of interest not only to the marine researcher but also to the layman interested in our marine resources. The purpose of this book is not just to describe what we know about the sea and its vast resources, but rather to point out what we do not know and those areas urgently in need of further study. The third volume is *Resource Training for Business, Industry, Government*, published by the Conservation Foundation for the Natural Resources Study Committee. This little book includes the proceedings of the first Ann Arbor Conference in 1956 as well as a number of articles by men actually working in fields where resource training is needed. It clarifies objectives and methods of graduate training for the sort of resource work required in business, industry and government.

Vanishing Open Spaces

Urban sprawl is the "bad word" for unplanned suburban growth. Many urban centers of the United States now suffer more and more from this kind of development on their fringes that needlessly chews up every open space and spreads population and essential services too thinly. Farming areas are prematurely bought for speculation, the suburban resident quickly loses local recreation space and central business districts decline.

A pamphlet by P. M. Stern of the Foundation staff on this resource development issue was recently sent to 400 newspaper and magazine editors. Specific suggestions included exclusive

agricultural zoning, acquisition of development rights by state governments and emergency community action to acquire strategic green lands especially valuable for natural features.

Dr. Osborn Speaks at Detroit

On June 3 Dr. Osborn delivered an address before the national convention of the General Federation of Women's Clubs at Detroit in which he stressed the need to understand the consequences of our current rapid population growth, especially as it affects our available resources. He concluded by saying, "I began this address as I end it — with the plea for *quality* rather than *quantity* in our national aspirations." His talk has received wide recognition and favorable comment.

Education Program

Dr. Paul F. Brandwein has spent the last few weeks in California and the Southwest where he has been observing the teaching of conservation in the Western schools. He also made arrangements for the establishment of a Conservation Foundation Curriculum Study Center at the San Fernando State College at Northridge, California, which will be under the direction of Miss Elizabeth Hone.

Forest Spraying

Early in June Roger Hale and Stephen Bergen spent a few days in Caribou, Maine, observing the airplane spraying of 300,000 acres of spruce-fir forests for the control of the spruce budworm. In connection with this spraying, we are conducting a research program on the effects of DDT on spruce-fir forest growth, as reported in the last issue of *ANIMAL KINGDOM*.

New Staff Appointment

On July 1 Richard A. Cooley joined our staff as Research Associate. He has spent a number of years with the Alaska Resource Development Board and has recently completed his doctoral studies in the School of Natural Resources, University of Michigan.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Oliver Named Director of Zoological Park

Dr. James A. Oliver has been appointed Director of the Zoological Park, effective June 27. Dr. John Tee-Van continues in the position of General Director of the Zoological Park and the Aquarium.

Dr. Oliver has been Curator of Reptiles since Sept. 1, 1951, and Assistant Director since April 28 of this year. He is a native of Caruthersville, Mo., and a graduate of the University of Michigan where he received his doctorate in 1942. From 1943 to 1946 he served on destroyers in the Navy. In 1947 he became an Assistant Curator on the staff of the American Museum of Natural History and was an Associate Curator from 1947 to 1948. For the next three years, before coming to the Zoological Park, he was Assistant Professor of Biology at the University of Florida.

With Dr. Oliver's appointment the Zoological Society reverts to a directorial system under which both the Zoo and the Aquarium have their own Directors, with Dr. Tee-Van exercising overall supervision. Dr. Oliver is the fifth Director of the Zoo: Dr. William T. Hornaday served from 1896 to 1926, Dr. W. Reid Blair from 1926 to 1940, Allyn R. Jennings in 1940-41, and Dr. Tee-Van (after a period as Executive Secretary) from 1952. He became General Director in 1957.



Dr. James A. Oliver

able in magnitude to the standard drug used for this purpose. The point is not that Holothurin will ever replace the drug, but that it may well show us new things about how nerve impulses operate.

It's "Dr. Ray" Now. Carleton Ray, Assistant to the Director of the Aquarium, was granted the degree of Ph.D. by Columbia University in June. His thesis was on "The Application of Bergmann's and Allen's Rules to Cold-blooded Animals."

Spring Babies. Many of the deer corrals now contain their usual spring quota of fawns. Jaguar cubs were born on June 24; they are three in number, and all males, and are being reared by their own mother in the Lion House. For the next few weeks they will be at their playful best.

IN BRIEF

Nerve-blocking. Early in his studies of the effects of the powerful Sea Cucumber poison, Holothurin, Dr. Ross Nigrelli noticed that fishes exposed to the substance behaved as if their nervous systems had been affected. Now Drs. S. L. Friess and E. R. Whitcomb of the National Institutes of Neurological Diseases and Blindness have discovered that Holothurin acts as a powerful blocking agent for nerve impulses, compar-

PUBLICATIONS OF INTEREST

TALKING OF ANIMALS. By David Fleay. 56 pp., 52 illus., Jacaranda Press, Brisbane, 1956. 13 shillings 6 pence.

Appropriately, a bright-eyed Platypus adorns the cover of "Talking of Animals," for David Fleay is "the Platypus Man" who twice in the past eleven years has brought Australia's greatest mammal treasure to the

Bronx Zoo. "Talking of Animals" is just as chatty, informal and unpretentious as its title indicates — and yet as packed with information as one would expect in a conversation about animals with a man whose whole life has revolved around the Australian fauna. Mr. Fleay devotes separate short, anecdotal, but always informative chapters to about 30 of Australia's mammals, birds and reptiles with which he has had close (sometimes too close) contact. The photographs, by Mr. Fleay, are mostly large and are excellent. — W. BR.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1958)

Patron

Will C. Grant
Miss Alice Tully

Life

Mrs. Robert Holt
Ilia A. Tolstoy

Supporting

Mrs. Dumont Clarke
James M. Doubleday
Wilbur Downs
Mrs. A. W. Erickson
Henry J. Heinz, II
Miss Helen M. Holmes
Russell C. Leffingwell
Mrs. John E. Post
Mrs. A. Hamilton Rice
William A. Rockefeller
Peter Stuyvesant
Miss Joan Van Orden

Contributing

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Frederick Bruell
Mrs. Antoinette M. Bunker
Mrs H. Schuyler Cammann
Mrs. Cass Canfield
W. Macy Chamberlin
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Miss Ursula Corning
Mrs. Wilbur A. Cowett
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Robert K. Ginsberg
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Ernest R. Heyde
James R. Hillas, Jr.
Mrs. Thomas Hitchcock
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Mrs. Robert A. Lovett
Miss Adele Marie

Paul W. McQuillen
Mrs. Charles S. McVeigh
Dr. Katharine Merritt
Mrs. Stanley G. Mortimer, Jr.
Mrs. Vernon Munroe, Jr.
Mrs. Warren O. Nelson
Constantine Nickou
Mrs. Charles S. Payson
Miss Frances Poe
Dr. Dominick J. Principato
Mrs. William H. Reid
Miss Ethel M. Shrewsbury
Mrs. F. J. Starzel
Harvey Stevenson
Mrs. Robert C. Stover
Mrs. Carll Tucker, Jr.
Gilbert Walerstein
Mrs. Philip B. Weld
Charles S. Williams
Horace H. Wilson

Annual

Townsend E. Anschutz
Mrs. Elizabeth A. Baird
Mrs. Gily E. Bard
Walter Bastedo
Miss Irma Berger
Leonard Bergstein
Mrs. A. S. Birsh
Del H. Brand
Dr. Paul F. Brandwein
Harold E. Bruce
Louis Casanave
Miss Deborah E. Clark
Mrs. Douglas Clephane
Abraham Concool
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Master Kim S. Gudgeon
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A. Nelson Hall
Miss Elizabeth Halsey
John F. Hamberger
Minard Hamilton
Murray Handwerker
F. Kenneth Harder

Frank K. Harder, Jr.
Mrs. Elizabeth S. Hausner
Dr. Robert Healy
Mrs. William Heitner
Dr. Alfred R. Henderson
Miss Bertha Hernstadt
Miss Frances A. Jones
Frederick Jones, Sr.
Theodore Kahn
Mrs. Eva Wehnes Knox
Done Ot Koon
Geza Korda
David I. Kronenberg
Master Nicky Leggett
Jonathan Lehman
Miss Laura H. Leonard
Mrs. Wallace A. Lindquist
Dr. Rudolph M. Loewenstein
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John H. Roos
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Mrs. Albert Schwartz
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Louis T. Tieman
Mrs. Kenneth V. C. Wallace
Joseph Watkins
Karl B. Weber
Miss Elizabeth E. Wehnes
Mrs. L. A. Wyman
Miss Katherine J. Zinsser

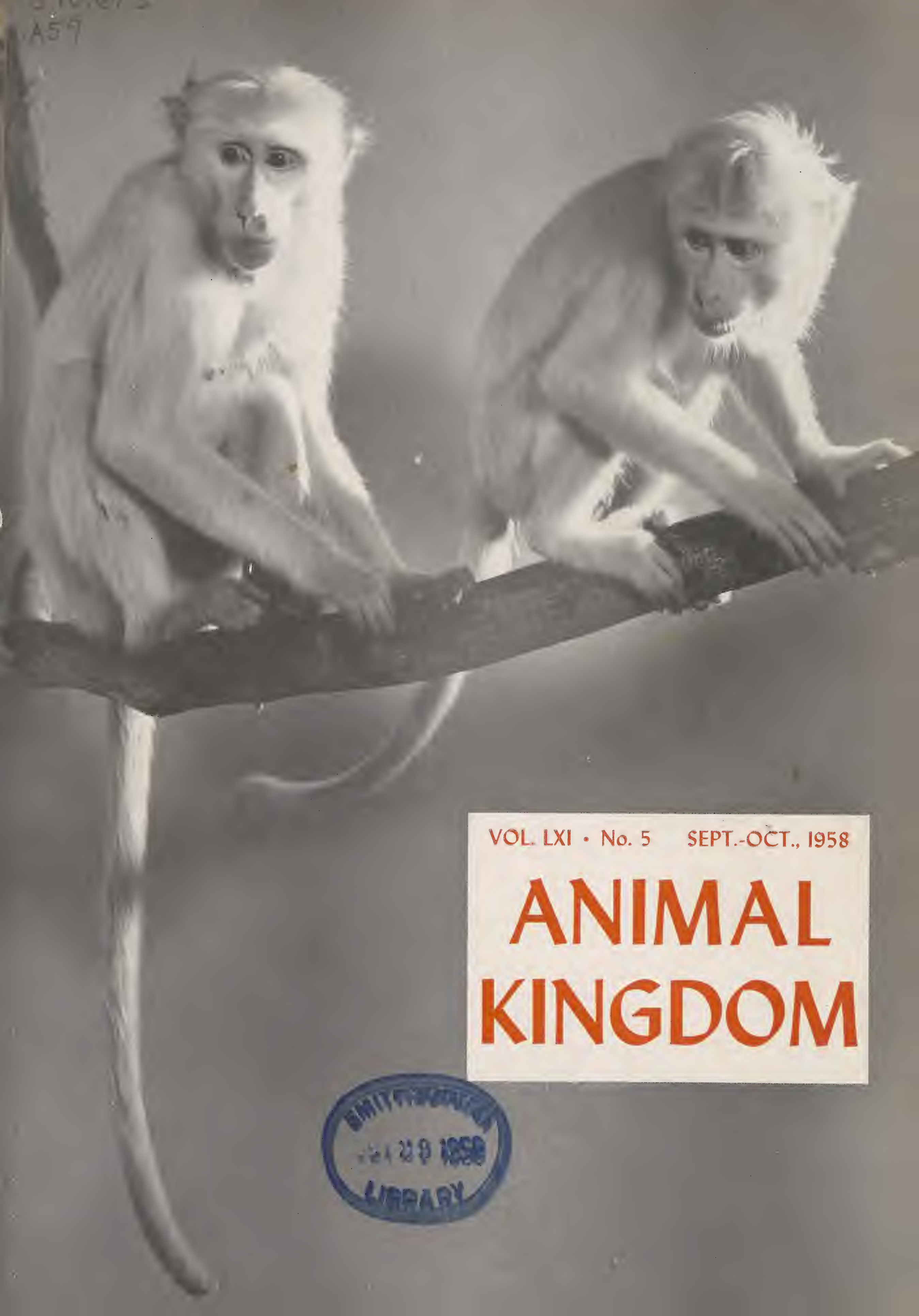
It's Summer Expedition Time

How long since you—a Member of the Zoological Society—have been at the Bronx Zoo or the Aquarium? This is a good time to make a trip to *both* of these show-places of New York. It's quite simple, especially by automobile. If you'd like to refresh your memory of the automobile routes, a telephone call to the Publications Office in the Zoo (WEllington 3-1500) will bring by return mail a couple of neat little folders with maps showing how to reach the Aquarium and street routings to the Zoo from any direction.*

Just about the time *Animal Kingdom* appears we think our newly-born Jaguar cubs will be old enough to come out and play with their mother. There are three of the babies, born June 24, and as cute as only baby Jaguars can be.

* Bring a friend along. Maybe he'd like to join the Zoological Society, too.





A59

VOL. LXI • No. 5 SEPT.-OCT., 1958

ANIMAL KINGDOM



General Offices: 30 East 40th Street, New York 16, N. Y.

Robert G. Snider

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LXI OCTOBER 1958 No. 5

Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.



The Mind of a Whale

THE GREAT MAMMALS of the deep — dolphins, porpoises and whales — have long held a special fascination for man. Yet the fact that their lives are led within the remote recesses of the sea has thwarted any real understanding of their ways of living and, more specifically, of the degrees of their intelligence.

"Deep-water" sailors perhaps have come to know them best. A while ago one experienced mariner told me with zest of his special acquaintance, a porpoise — easily identified from the rest of the school because of a large white mark on his head. This animal stayed with his sailing ship for more than a week, swimming just alongside the prow at intervals, where my mariner friend, balanced on the bow-sprit chain, stroked him with his bare foot to the evident delight of the animal who, after this daily treat, would go bounding off into the ocean, to return later. Then there was the famed "Pelorus Jack," the dolphin which for many years took its station in Pelorus Sound in New Zealand, waiting to guide incoming ships to their moorings. Incidents such as these are numerous in the annals of the sea, yet in themselves provide little understanding of the minds of these remarkable animals.

Now, however, it is possible to study them far more intimately. The construction within recent years of really large "oceanic" tanks, such as those in the "Marineland" of Florida and California, as well as that in our own new Aquarium, permit far closer observation of the characteristics of these animals than ever before. True, the ability of sea lions to learn tricks has long been recognized, but they live semi-terrestrial lives and we have come to think of them as different from the mammals whose lives are spent in the reaches and deeps of the ocean. Now, in their new environments, it is possible to observe intimately the true oceanic mammals such as the porpoise and the whale. Their evident intelligence and their readiness to "respond to new ideas" are nothing short of a revelation. Recently I had the privilege of "shaking hands" with a whale.* While doing this I happened to recall that the sequence and arrangement of bones in his flipper are identical with those in the human arm and hand. Irrespective of this bond of physical similarity, I had the curious feeling of having been accorded an expression of trust and an "honor" that will not be forgotten.

Fairfield Osborn

* See photograph on Page 159.

To Australia and Back with Animals

By ROBERT RAABE



It looks easy — the way Robert Raabe is holding this Echidna, or Spiny Anteater, with his bare hands. The spines are undeniably sharp, so the trick is to hold the soft underbody.

IN THE FALL of 1957 Robert Raabe, then a keeper in the Reptile House, yielded to an impulse. He had always wanted to see something of Australia, and when the opportunity was offered him of working for a few months as a keeper in the Taronga Zoological Park in Sydney, he took it.

A collection of Australian mammals, birds and reptiles, including several rarities, had been offered to us by Sir Edward Hallstrom, president of the Taronga Zoological Park Trust, and Mr. Raabe undertook to look after them on the voyage to New York. He arrived on July 26 with 28 animals, all in excellent condition. This is his account of the trip home.

GETTING a collection of animals ready for shipment to the other side of the world is an old story to Sir Edward Hallstrom and his staff at the Taronga Zoo. They have done it so many times that on sailing day everything falls into place, seemingly automatically but actually as a result of the kind of planning that leaves nothing to chance.

(There *was* one little bobble, one hitch in the smooth routine. At loading time, stevedores were supposed to carry the animals aboard the ship and deposit them in their pre-arranged locations. But the stevedores balked at carrying the tank of sea snakes, so I tucked it under my arm and carried it aboard).

The collection chosen by Sir Edward for presentation to the Bronx Zoo was not large but there were some choice creatures on the list:

- 2 Echidnas, or Spiny Anteaters
- 3 Great Gray Kangaroos
- 2 Agile Wallabies, one of them a baby in the pouch
- 1 Wallaroo
- 1 Wombat
- 1 Papuan Cassowary
- 4 Kookaburras
- 4 Tawny Frogmouths
- 2 Eyton's Tree Ducks
- 4 Brush Turkeys
- 2 Pitted-shell Turtles
- 1 Johnson's Crocodile
- 3 Banded Sea Snakes

My Bronx Zoo experience with the shipping of animals had been confined to reptiles, and that is simple enough; if it is a snake you put it in a stout cloth bag, put the bag in a stout wooden box with a stout screen ventilator, and nail the box shut, or padlock it.

With birds and mammals, the trick is not quite so simple, for the shipping crates need to be tailored to the animal, well ventilated (for while we were starting out at the beginning of the Australian autumn in mid-May, we should be sailing through the tropics and arriving in New York in mid-summer), and for the excitable Papuan Cassowary, extremely well padded to keep the bird from bashing its head in. As a matter of fact, I

thought at one point that cassowary was not going to need its luxurious crate; it took six keepers to catch the bird and transport it from its paddock to the staging area.

Anyone who has to transport a miscellany of animals should certainly bless the people who invented plastic bags and modern refrigeration. How they simplify the food problem! Well in advance of sailing day, meat was ground, weighed into daily portions, quick-frozen in plastic bags and stacked up for quick transfer to the ship's refrigerators. Fish were frozen, too. Grains for the kangaroos and wallabies were blended and bagged — just so much to a bag as was considered sufficient for each animal. Fruit, vegetables, powdered and condensed milk, cracked corn and wheat — all could be bagged in advance and forgotten about until it was needed.

We were to sail on the *SS Pioneer Reef* of the United States Lines, the ship that had carried me out to Australia seven months before. A large wooden platform had been built on the after deck and here the cages would have plenty of circulating air and drainage. It was a good thing, too, for as we sailed out of Brisbane after a three-day stay, a cyclone swept through from the northeast and I and as many of the officers and crew as I could round up spent the early evening, in pelt-ing rain, lashing the crates down. Warned by radio of the approach of the storm, I had given extra rations to the animals.

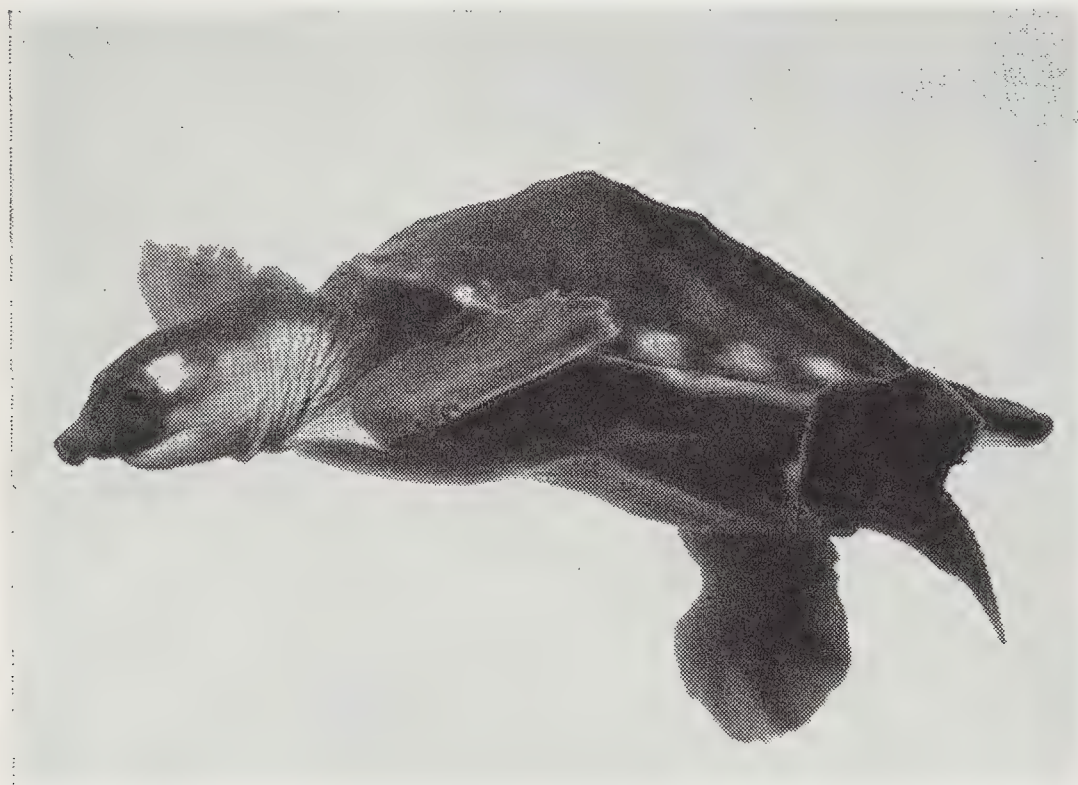
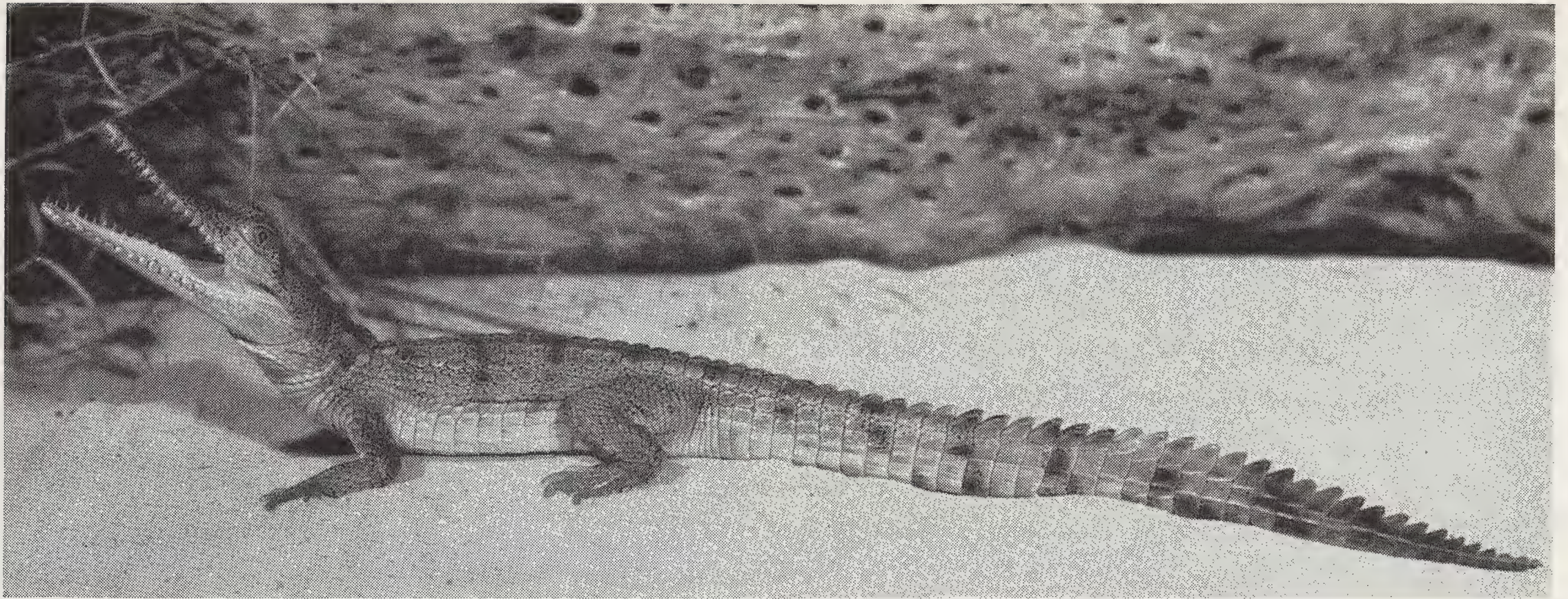
Everything took the storm in stride. The kangaroos, wallabies and the wallaroo seemed to pay no attention to the roll and pitch of the ship — perhaps because of their low center of gravity! It was most disconcerting, I suppose, for the cassowary, for many times just as it was reaching for a bite of food, the ship rolled and the bird either overshot the mark or found itself sliding backward away from the dish.

That was a smart cassowary, though. A few of those overshootings and undershootings, and it simply folded its legs and squatted on the floor right in front of the food tray.

My most interested charges, I think — interested in shipboard life — were the Kookaburras, or Giant Laughing Kingfishers. They were fascinated by the sight of any other bird and an albatross, petrel or gull somewhere within their vision would set them calling at any time of day. Thanks

One of the Great Gray Kangaroos is quite tame and several times Mr. Raabe has taken it on an early-morning walk around the Kangaroo House. Now it lives in the Children's Zoo.





*The intimidating reptile above is a very rare specimen from northern Australia which we are exhibiting for the first time — Johnson's Crocodile, *Crocodylus johnsoni*. At the left is an even greater rarity, the Pitted-shell Turtle, *Carettochelys insculpta*. The Papuan Cassowary below is one of the smaller cassowaries.*

to the Kookaburras I spotted several sea birds I would otherwise have missed.

Northward out of the Panama Canal I lost the Wombat after a four-days' illness, and one of the Echidnas. The Echidna never had adjusted to an artificial diet and I was not surprised at its death. Still, there was one fine Echidna left and it will eventually be exhibited alongside the three Duck-billed Platypuses in the Bronx Zoo, I understand. We will be the only place in the world outside one or two zoological gardens in Australia where *both* the monotremes can be seen alive.

The Kookaburras, I am sorry to say, have gotten over their preoccupation with other birds. Almost any time of the day they can look out of their roomy compartment on the east side of the Bird House and see a Herring Gull floating down to the Sea Lion Pool. But it never sets them off in a burst of raucous laughter the way it did aboard ship. Visitors like to hear them call, and they do call in chattering unison occasionally during the day. But the only time you can be sure of it is first thing in the morning when the keeper brings their breakfast.



The Birth of Soondar Mooni

By E. O. SHEBBEARE

The author of this excerpt from a forthcoming book was born in Yorkshire 74 years ago and from 1906 to 1938 worked for the Indian Forest Service; after that he was Chief Game Warden in Malaya until 1947.

The Indian Elephant called Soondar Mooni was more than 30 years old when Mr. Shebbeare first encountered her. His account of her birth, capture, training and the vicissitudes of her early life are of course supposition—but supposition built on a long and loving acquaintance with elephants, working and wild.

With the permission of the Houghton Mifflin Company we are printing the first chapter of the book "Soondar Mooni," which will be published on October 7. That chapter, "The Herd," speaks for itself as to the quality of Mr. Shebbeare's writing and knowledge.—ED.

THE LITTLE HERD of fifteen elephants had hardly moved from one spot for nearly three days. This was unusual. The patch of jungle which they had chosen as a halting place already looked trampled and stale, with all the favorite kinds of fodder grazed flat. Farther afield in the surrounding forest, although most of the undergrowth was still standing, narrow paths in all directions showed where single animals had strayed out and back in search of something more appetizing than the bruised herbage at the center of their stamping ground, which was beginning to smell sour. The spot they had chosen was a half-moon-shaped patch of wild cardamoms, about ten acres in extent, and was

bordered on one side by a pretty, gravel-bedded stream and on the other by a vertical bank about fifteen feet high beyond which the tree forest lay unbroken for mile after mile. Tall trees grew to the very brink of this miniature precipice and a few of them had leaned over the edge and lay horizontally but continued to flourish, sending a forest of side branches up toward the sky.

A mile or so to the north lay the boundary of Bhutan, and here the level floor of the forest rose abruptly in precipitous hills which climbed, in jostled masses and long-backed ridges, to join the great backbone of the Himalayas, twenty thousand feet or more in height and only about thirty miles away as the crow flies. It may seem strange that this bleak and icy main ridge should lie at so short a distance from a spot where elephants were feeding on tropical vegetation. It was in fact visible from where they stood, for a long straight reach of the stream made a break in the green canopy of the forest and there, standing above the treetops at the next bend, were the Himalayas themselves. The parts of the great range most prominent in this landscape were no more than, as it were, false summits masking higher mountains behind. Beyond the tree-clad foothills rose purple uplands, now dusted with winter snow; a few peaks were already white, but no summit in the view to the north was more than about fifteen thousand feet in height. If your eye followed the skyline away to the west, however, it would catch the unmistakable glint of permanent snow: Kangchenjunga, the third highest mountain in the world which, although a hun-

dred and twenty miles away, shone clear as a diamond in that crystal air.

It was indeed a lovely spot, and perhaps the elephants, with minds engaged upon the more practical quest of fodder, felt a vague contentment in the peaceful beauty of these well-known surroundings, although they certainly had not made this long stay to admire the view. It is likely that some of the younger members of the herd had no idea why they were stopping so long. The youngest of all, a bull calf fourteen months old who, having just learned to graze a little on his own, was beginning to consider himself rather an authority, could not recall in his whole experience anything like so long a halt before.

The forest which I have described lies in the northwest corner of Assam. The elephants belonged to the Asiatic species which lives in the moist forests of India, Ceylon and Burma as well as in Siam, Indochina and Malaya. This is the animal best known to most of us, who have seen them in zoos or in the circus; the larger African type, plentiful in huge herds in many parts of their native land, was until quite recently almost a rarity in Europe even in big zoos. These African animals are very different in appearance and, to those who know the Asiatic elephants best, seem almost caricatures, with their enormous ears and, to admirers of their Asiatic kinsfolk, rather ugly backs. Maybe to those who know them well, the African elephant appears the finer animal. In the first place they are bigger; bulls are said to grow to twelve feet and cows to ten, whereas Asiatic bull elephants seldom reach ten feet at the withers and the usual height of a cow is about eight feet. Then the tusks, chief glory of an elephant, are much bigger in the African variety, and the cows carry them as well as the bulls. In Asia only bulls carry ivory and not even all of them, for there are males, called *makhnas*, that are just as big as the tuskers but are tuskless. In India and Burma *makhnas* are almost as common as tuskers. In Malaya a *makhna* is quite a rarity while, on the other hand, in Ceylon the rarity is a tusker. Both *makhnas* and cows, though they have no tusks, have little "tushes" pointing downward like those of a walrus: these are sometimes nearly a foot long but generally get broken off before the elephant is middle-aged.

To return to the little herd in Assam; the rea-

son for their stopping so long in one place was, of course, that a calf had been born. Though elephant calves are capable of standing, or even walking several miles, within a few hours of their birth, adult elephants prefer both mother and child to rest for a few days. The leader of the herd had accordingly called a halt. To say "the leader called a halt" may give a false impression; anyone who is not familiar with the ways of wild elephants might perhaps picture a magnificent tusker turning to face his followers and bellowing his commands after the manner of a sergeant major on parade. This is not what happened at all. In the first place the leader of the herd was not a tusker but a venerable old cow — almost the least conspicuous elephant among them — and she issued no orders, at any rate no audible ones. There was no need. She simply stopped, and the rest, accustomed to follow her lead, stopped with her.

It may seem strange that a herd of huge animals should have chosen as their leader this little old cow; for, being over seventy years old and considerably shrunken with age, there was nothing spectacular about her. It was, perhaps, hardly a conscious choice at all. Certainly they had held no talkative meeting, as men might have done, to decide who should lead them. It had all come about in the most natural way, it being the instinct of calves to follow their mothers and of family parties to hang together; so that, in a herd of elephants, which is no more than an overgrown family party, their leader is generally the oldest cow among them. But, in this grandmotherly form of government, how comes it that the bulls should take no part? A bull elephant, especially a tusker, is feared not only among his fellows but is treated with some respect even by his most dangerous enemy — man. One would have expected the biggest bull to become the champion, leader and protector of the rest, as he sometimes does in some other species which, like elephants, travel in herds; this is characteristic of the herd bulls among the gaur, the biggest cattle in the world, which often share grazing grounds with elephants.

If you are fortunate enough to get within sight of a herd of gaur you may have a chance of seeing what a protector the big bull can be. At the first breath of danger — and "breath" is the

right word, for all warnings reach them first on the wind — the animal that first scents your approach will throw up its head, with eyes and ears alert, and face the direction from which the smell of a stranger seems to be coming. One by one the nearer animals become uneasy, watching their sentinel for further warnings, while cows with young calves begin to move quietly off to the far side of the herd. Sometimes, but not often, you may hear their curious alarm call, a strange sound for cattle to make, rather like the deep whistle of a railway engine. Then the big bull, satisfied that this is no false alarm, makes his way slowly but fearlessly in your direction, generally with a few of the bolder of his companions following cautiously behind, and there he stands peering into the shadows of the forest with twitching ears and lashing tail — for they are much worried by flies. What a magnificent sight he is as he stands there! In shape he is not unlike a perfectly proportioned short-horn bull, but in far harder condition than any domestic bull, with great muscles rippling under his glossy skin. He stands as high at the shoulder as an eighteen-hand cart horse, which means six feet, but, being short in the leg, his great barrel chest is far deeper. In color he is almost black with just a suggestion of bay points, except for the four white stockings (which reach above his knees and hocks) and white or pale chestnut hair across his wide forehead between the horns. His horns, though not very long, are as thick, at their crinkled bases, as the calf of a strong man's leg — the pair of them, shaped like an exaggerated crescent moon with tapering tips almost pointing at one another, are beautifully symmetrical. He is an impressive beast and his demeanor, when he sights you, is frightening: he advances a few paces, stamps, snorts and tosses his great head as if he were about to hurl his whole terrific weight of bone and muscle headlong at you. You may remind yourself that a determined charge by an unwounded gaur is almost unheard of — nevertheless you will be able to watch him more calmly if you are standing close beside a good-sized tree. All this threatening display is no more than a sort of "bluff," which gives the cows and calves under his care time to put a safe distance between themselves and danger. Without once taking his eyes off you he judges when they will have reached

safety, then, in a flash, he will swing round in his own length, gathering his great hocks under his weight as he turns — one plunge and he is thundering off through the undergrowth after his companions. He may check after this first wild dash and, half turning, assure himself that he is not being followed before trotting off — the gallant rear guard of his party. I have called it a "bluff," and so it is, but a bluff that must have cost many a herd bull his life since the day firearms were invented.

One seldom hears of anything like this among elephants. On the contrary, if a bull happens to be with the herd when danger threatens, he is generally the first to leave. But then, unlike gaur, bull elephants when once they are seventeen or eighteen years old, and approaching their full height, pay the herd only occasional visits which do not entail full membership. It is not that they dislike female society, but they have a wholesome respect for their male relatives; youngsters are not encouraged to be present when an older male is paying a visit to the herd. Nor do elder males fraternize among themselves. Although instances of a sort of David and Jonathan partnership between two young tuskers are not unheard of, bulls normally give one another a wide berth and take care that their visits to the herd do not coincide — a chance encounter has been known to end in the death of one of them.

One might suppose that the leadership of a small herd of elephants such as I have described would call for no special talents. To a casual observer their leisurely journeys from one patch of rich fodder to another, among seemingly inexhaustible supplies, might appear no more than aimless wandering, but it is not quite as simple as that. Like most grazing animals, elephants need a varied diet to keep them fit and each of the many plants they feed on has its own season — at one time it may be tasty and nourishing, at another unpalatable and useless. Even the wild cardamom, often for long spells almost their staple diet, has its off season. It was not by chance that this herd always found themselves where the fodder, whether grasses or creepers, bamboos or fig trees, was just at its best. It would be a mistake to think of their shrewd old leader as thoughtfully planning a tour that would bring them to the right place at the right time. Her

mind did not work like that. It was rather that, after seventy years of grazing over the three or four hundred square miles that had been the pasture of her ancestors for countless generations, she had developed an unconscious sense that led her to the spot best suited to serve the needs of the herd. Nor was it only a question of fodder: any mistake on her part during a drought might place the herd in a position of great discomfort; or, during a monsoon flood, the bad choice of the point at which to ford a stream might mean death for some of them. Though an excellent swimmer, even so large an animal as an elephant may be dashed to death against rocks should it lose its footing while fording a Himalayan torrent in spate, as is shown by the huge distended carcasses which sometimes float down the Brahmaputra during the rains. The instinct of the old leader never failed to interpret any sign on the face of nature that might affect the welfare of her herd.

It was already three days since she had halted them. Out of the tail of her eye, as it were, she had noticed the cow, the cause of this delay, turn aside and force her way between the close-packed, aromatic stems of a cardamom patch that grew on the soft, moist earth beside a trickling runnel. The message had not been lost on her. How often, in days gone by, had she not herself sought just such seclusion? It had come as no surprise to her; indeed, she had half-consciously foreseen it a week earlier and, instead of heading northward toward the foothills, where there was a salt lick which was due for a visit, she had turned south to follow the stream out into the plains. Here water and plentiful fodder would always be within easy reach wherever they might have to stop.

In the last few moments she had become restless; something in her

brain that ticked steadily over like an alarm clock told her that the time was at hand when the herd should be on the move again, and she began to drift slowly in the direction of the cardamom patch, grazing as she went. She had judged the time well, for, as she came opposite the narrow cleft in the wall of upright green stems that marked where the cow had entered, there was a slight movement in the tops of the cardamoms. A few moments later a trunk parted the crowded stems, giving a glimpse of the massive forehead surging gently forward, and soon the great head was clear. Sheltered between her trunk and forefeet stood a strange little object barely three feet high. It looked a weary little creature, at this stage almost frail, and rather hunched up because its drooping head and tail seemed to have bent its back into a high-pitched arch. Pushed and guided by its mother's trunk it stumbled forward uncertainly, for it was only half awake. Though its own trunk was still absurdly short and its body covered with the auburn bristles of babyhood, there was no mistaking what it was — a healthy, very young elephant.

One glance at the calf was enough to satisfy the old leader that all was well. Turning to the left, she forded the shallow stream and set a course that would lead back to the salt lick after

a week or so of leisurely grazing. The route lay along the high bank on the opposite side which she had avoided on her way downstream, and she thought gratefully of the clumps of bamboo which would become more and more frequent as they approached the foothills. She did not want to see cardamom again for some time. The splash of her feet crossing the water was all that her straggling followers needed to tell them that they were on the move again at last.



Fine Feathers



Make the Bird



By WILLIAM G. CONWAY

TOMORROW MORNING, sometime after nine o'clock, the Bird Department telephone will ring. A concerned voice will describe some pet bird's infirmities and particularize, sooner or later, that "Birdie," "Robert" or "Jocko" is losing his feathers. The Bird Department will explain to the owners of a good many of these pets that the birds are not ailing but just plain molting; that it is a normal process by which birds replace their worn feathers. The explanation is usually greeted with surprise and relief, for many pet keepers seem not to know that most birds replace each feather of their plumage at least once a year.

Molting, however, is not peculiar to birds. Snakes shed their skins and countless other animals, from lobsters and spiders to salamanders and deer, shed their various wrappings from time to time. These shedding or molt processes are often related to growth or development and are analogous to bird feather molt. In each case the creature concerned emerges with a new suit of some sort.

Feathers are believed to have evolved from the scale structure of the bird's reptilian ancestors, so we would be right in supposing that bird molt and reptile skin shedding are closely related. Even today, of course, most birds are wearing ancestral "socks" of scales, as a look at your next Thanksgiving Turkey will reveal. These leg and foot scales are sloughed and replaced at intervals much like the scales of reptiles.

In captivity, where birds may live a life of leisure and fail to wear off old leg and foot scales, troubles sometimes result. Layer after layer of scales grow out from the birds' legs under old, hardened layers which have not worn or fallen

off. The result is somewhat like the plight of a man who has developed a 44-inch waist and is still trying to wear his collegiate 31-inch belt — serious constriction. At the Zoo we find we must capture certain birds several times each year and peel off these scaly layers, a sort of avian pedicure usually accompanied by a thorough check-up, manicure and bill clipping. Some herons in the Aquatic Bird House are adept at evading capture and occasionally develop an almost bobby-soxer-like appearance.

The number of these leg scale layers is amazing. We might expect birds to replace scale layers in coordination with feather molt. Molt usually operates on one annual cycle or, more rarely, reaches two peaks of plumage growth and replacement during the year, so that birds ought to put on one or at most two pairs of leggings each year. But I have frequently peeled as many as five layers of scales from a bird's leg at six-month intervals.

Some species even molt the keratinous outer layers or plates from their beaks. The Emperor and King Penguins lose and replace large pinkish shields from their lower bills and some of the hornbills drop huge flakes from their strange beaks and head casques. These particular cases do seem to operate on an annual cycle and may be closely connected with feather molt. Beak shedding is not restricted to large birds, for even birds with slender, sensitive bills such as the Willet (a large sandpiper-like shorebird) may shed large pieces of beak covering under captive conditions. Probably this process is much less spectacular in the wild, where constant wear from probing in sand and mud precludes the build-up of thick, horny, bill covers.

Feather molt is, of course, the basic molt problem for birds. Feathers provide most of their color and ornaments, but more vital, they serve as insulation and waterproofing and aerial apparatus. While flightless birds such as ostriches and rheas, cassowaries and emus, kiwis and penguins, may have only an ancestral interest in the problem, how is a flying bird to renew his feathers and yet remain airborne? I should take a very dim view of an air transport company that casually sent a few mechanics along on my next air trip, hammering and rebuilding the wings and fuselage of my airplane as I attempted to relax my safety belt to down a "continental breakfast." Yet picture the dilemma of, say, the chimney swift, which feeds entirely upon flying insects captured in mid-air and cannot really walk on land. Its molt problem is solved by gradualness. The flight feathers of wing and tail are dropped and regrown in a special sequence. In the same way, a thrasher may drop the fourth feather from the tip of each wing. Sometime later, when the fourth feather replacements are well grown, the bird drops the fifth feather on each wing, and so forth. The molting sequence is usually peculiar to a species or group and a warbler might start with the loss of different flight feathers and renew its plumage in an entirely different order.

Although many birds have solved the problem of donning fresh wings while flying, some groups have a flightless molt. These birds drop and regrow all of their flight feathers at approximately the same time, or in a very short space of time, and find themselves grounded until their new flying equipment is grown. This technique is not quite as hazardous as it might seem, for most birds which undergo flightless molt are waterbirds which can retreat from land predators to the safety of lakes and bays. Furthermore most of them can get all the food they need in the water without flying. There is one hazard, though. Men of many lands, from Eskimos to Caribs, have learned of this comparatively vulnerable period and know how to take advantage of it. During the molt northern geese and swans are herded out of the lakes and estuaries where they have taken refuge and are slaughtered by Laps and Eskimos for food and other uses. Flamingos are similarly captured at the Equator.

Many alcids (Puffins, Murres, and their rela-

tives) also undergo a flightless molt. The problems of their particular molt were brought home to us this year by our young Puffins, for they became virtually wingless and tail-less in early March. To the human mind these little birds, weighing scarcely a pound, undergo an especially unpleasant ordeal while growing new feathers, for they float far from land, paddling about through the late winter storms of the North Atlantic at molting time. Yet they survive this period of great physiological strain in what appears to be an extremely hostile home when they seem most poorly equipped.

The physiology of bird molt and the mechanism of its control are poorly understood. The drain upon protein and mineral reserves in some molting birds must be very great, especially in those species which drop and regrow a great many large feathers at one time. The sheer physiological effort involved in the production of large, heavily mineralized protein structures such as flight feathers is something that most of us cannot really comprehend; it is almost as if we were to shed all our fingers and toes this evening and had to grow them back in a week or so. There is, we know, a great actual breakdown of calcium in the bones of some birds during molt. This is a thing we try to keep in mind when catching up birds in our collection, for it has been suggested that a bird might be more susceptible to fractures when molt is drawing upon the calcium reserves of its bones.

The basic metabolism of some birds is highest at molting. Two research men measured the basal metabolism of eight domestic hens and found that oxygen consumption (in cubic centimeters per kilogram of body weight per hour) averaged 460 cc. during summer laying, 666 cc. during the autumn molting period and 448 cc. during the winter laying period. Thus the metabolic rate had increased almost 50% during molting. They suggested this might be due in part to loss of heat when the hens had lost much of their feather insulation. We also know that thyroid is important in molting, and that *sometimes* molting may be induced by thyroid-active substances. Acting on this principle, last year we attempted to induce our Gentoo Penguin to molt by means of one of these substances. This bird, named Tracy, has not completed a normal

molt in several years and he presented a very worn appearance. First we weighed Tracy and found that he tipped the scales at $13\frac{1}{4}$ pounds. Each day for nearly two weeks Keeper Salvatore Solanto slipped a thyroid pill into the penguin's fish. Each day we watched Tracy for some change in appearance or behavior and some increase in weight. Tracy watched us. At the end of two weeks, he weighed the same $13\frac{1}{4}$ pounds. We quadrupled the dosage and resumed the mutual watching program. When we finally abandoned this experiment, Tracy still weighed a comfortable $13\frac{1}{4}$ pounds and behaved precisely the same as when we had begun — though I knew he had consumed enough thyroid to turn his antarctic courtship antics into a highland fling.

Removal of the thyroid has been shown to decrease feather growth rates and to produce changes in feather structure in some birds. The

feathers of chickens, pigeons and some ducks become plumelike, fringed and elongated. Sometimes profound color changes occur. Perhaps some day we will be able to control the molt of our Zoo birds so that we may exhibit birds of paradise in full plumage in the Spring, rather than in the Fall when visitors are fewer. For many exotic birds cling to the molt time-schedule of their native lands and when our local birds are at their best, in the Spring, birds from countries in the other hemisphere may be at their worse, in tune with Fall at home.

In contrast to the molt of other birds, penguins undergo a really appalling divestment. Unlike

Each spring our King Penguins go through molt and for 3 or 4 weeks they look like this. The lower mandibular shield is shed also. During the molt they neither feed nor go in the water.



the gradual molt of most land flying birds or even the sharp molt of wing and tail feathers in many water birds, penguins normally molt their complete plumage (flippers, head, body and all) in one grand effort. In our Penguin House the keeper first realizes a molt is drawing near when a penguin's appetite shows a decided quickening. As the bird builds up fat for his ordeal he may treble his normal intake of fish. Soon the penguin assumes a swollen, uncomfortable appearance and a few feathers loosen and fall. In a very short time the molting bird looks completely miserable and seems clad in a very rough and badly moth-eaten coat. Usually he gasps, is inactive and refuses all food. We find that molting does nothing to improve a penguin's disposition! In two or three or more weeks, however, when our penguin keeper feels sure he cannot bear to carry out another mass of sodden feathers, a much slimmer and beautifully bright and clean bird emerges from his annual molt.

When a bird loses feathers in an accidental way, he needn't usually wait for the next molt to replace them. When a feather is pulled out completely, the feather follicle begins, almost immediately, to regenerate a new feather. If, however, a feather is merely broken and the shaft remains embedded in the follicle it will not usually be replaced until the molt. At the Zoo we use these facts constantly. Very frequently birds arrive from a long journey with their feathers so badly broken that they are unable to fly, or they may look so shabby we cannot exhibit them. It must be remembered that feathers are dead structures, like hair, which will not heal if broken. Consequently, after carefully acclimatizing a new bird with badly broken feathers, we may gently remove the broken feather stumps and thus stimulate production of a new tail or wing.

Some birds lose their feathers so exceptionally easily that we believe they must have considerable control over the grip the feather follicle maintains on the feather base. It is not hard to see how such an adaptation could be useful to a bird when attacked by an enemy. If the predator fails to actually fasten his teeth or claws in the flesh, a "loose-feathered" bird might make his escape, leaving his would-be captor with part of an empty suit! This kind of loss of feathers has

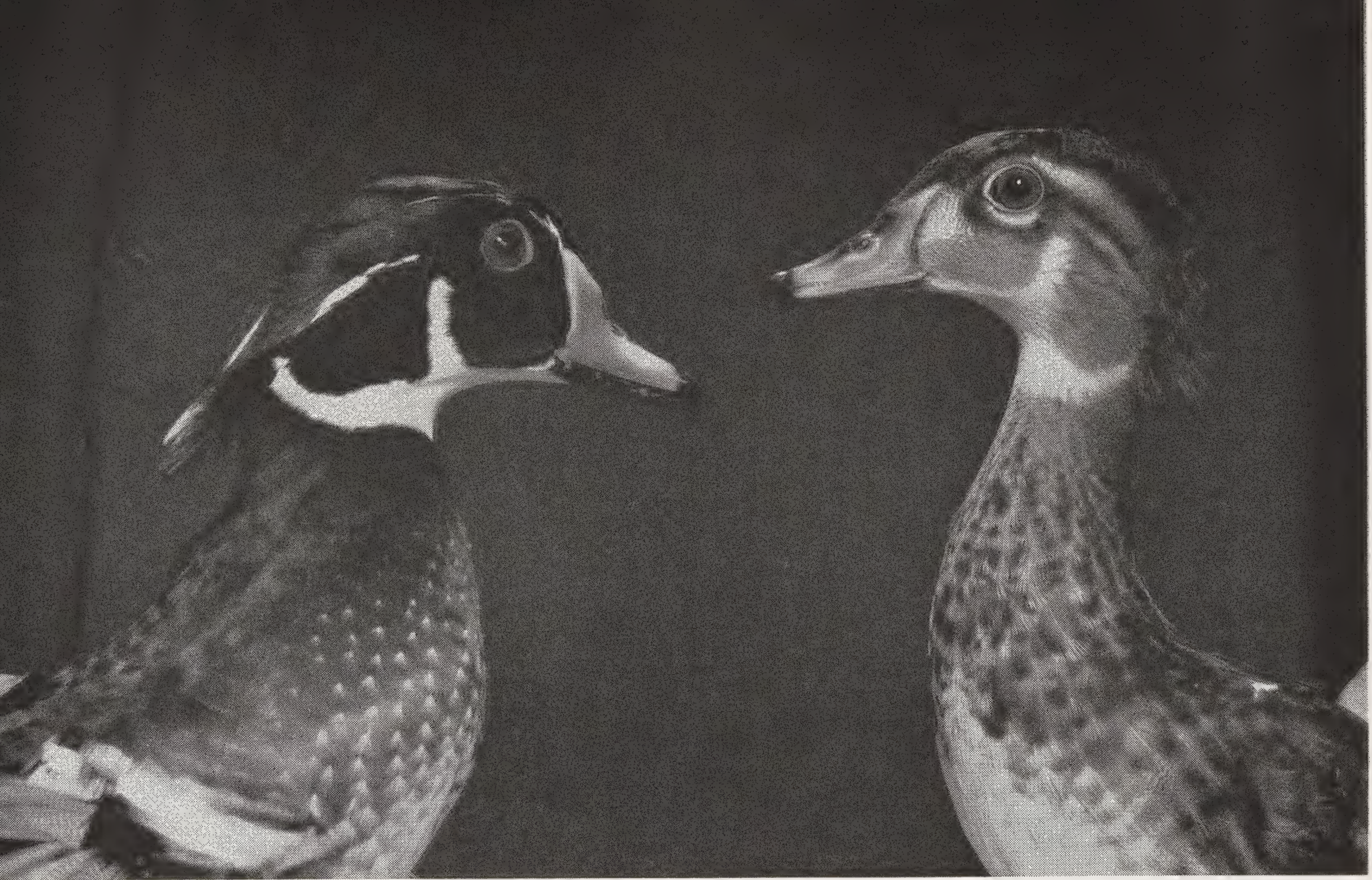
been called "fright molt." Some species lose their feathers so easily — especially the tails in long-tailed birds — that we are wary of handling them at all. I have sometimes made a slight error in judgment when catching up a touraco and have emerged from a veritable explosion of feathers with something more fit for a platter than the Society's collection. Touracos and certain pigeons seem to have this strange feather-losing ability unusually well developed. In most cases, the victims of such an experience take little lasting harm.

The dietary needs of molting birds are something we must consider carefully. Foods too low in vitamins, proteins and minerals may make it

Two male Wood Ducks — but what a difference in their appearance! The one on the left is in full breeding plumage, the other in eclipse. The latter will molt in about a month, like its companion

impossible for a bird to produce normal feathers, or even to molt at all. While for most birds we have solved this problem, loss of color is still extremely vexing. Red, orange or yellow colors, due principally to complex carotenoids which birds obtain in the wild from certain foods, are likely to appear badly faded in birds which have molted in captivity. Thus the bright reds of some barbets and woodpeckers fade to pinks or oranges. Yet, for some inexplicable reason, birds of other species fed precisely the same food, in the same cage, retain their brilliant yellows, oranges and reds. Our native Scarlet Tanager rarely achieves more than a deep yellow color, but the Brazilian Scarlet Tanager seems to molt deep red on every zoo's normal diets. Like most dietary problems of wild animals, the situation is complex and considerable empirical experimentation will be needed to develop practical solutions.

One molt problem, which at first I took to be dietary, concerned a male Quetzal. This "most beautiful bird of the New World" was an old specimen and it produced an especially fine train each year, of shimmering, golden-green plumes that were often more than two and a half feet long. But then, repeatedly and for no apparent reason, we began to find half-grown new plumes on the cage floor and the Quetzal's customary glorious train did not develop. I imagined all



sorts of dire things, reviewed the diet and examined the bird, all to no avail. It was a mystery until one day I was strolling by the group cage and happened to glance up just at a critical instant. A female Cock-of-the-Rock, roosting directly below the Quetzal, looked up as a half-grown plume brushed her face, grasped it, and neatly wrenched it out!

The most fascinating aspect of molt, to me, is change of color and pattern. It is amazing to watch a downy little brown-and-yellow Mallard duckling gradually become a large, variegated-brown, fully-feathered duck with no visible trace of down. Then, should it be a male, to molt through another phase to become a brilliant gray-white-and-black bird with a metallic green head and white collar as Spring approaches. In July we are again amazed to watch yet another molt and to see an almost female-patterned, brown-colored bird appear. All these variously hued and patterned feathers are produced from the same feather tracts and usually the same follicles. The total complexity of this sort of molt mechanism is almost beyond grasp. I suppose we can only compare the gradual graying of our own headwear as time goes on — and this takes most of us a large part of our lives to achieve! Juvenile birds whose pattern differs greatly from that of their parents have often been described as new species. The

immature Bald Eagle, which has no white head or tail, was once so identified.

The differences between male and female plumage in sexually dimorphic species are influenced by gonadal hormones and thyroid. Work on domestic poultry indicates that these differences are due to female hormones (estrogen) rather than male hormones (androgen). Castrated males still develop feathers male-like in structure but castrated females, producing no estrogen, also develop male-like feathers. Occasionally age performs experiments of this nature for us. Last year, we noted that an extremely old Mongolian Pheasant hen seemed to have vanished and in her place was an extremely shabby, decrepit old male. A good close look solved the mystery. Our female had reached an age when she no longer produced estrogen and forthwith had assumed male-like plumage. Her subsequent death and autopsy proved our guess correct. A female Congo Peacock brought back for us by Charles Cordier some years ago did the same thing and thus dashed our hopes of breeding this extremely rare bird in captivity.

While a great deal has been learned about molt in recent years, the whys and hows still offer some of the most interesting gaps in our knowledge of birds. I find it very hard to walk by each stray feather without wondering a bit.

The Longfin Pompano

COMMON BUT RARE

By JAMES W. ATZ

VISITORS at the Aquarium often ask what is the largest fish on exhibition, the fastest, the most dangerous or the most expensive. These questions can all be answered to their satisfaction, but when they want to know what is the *rarest* fish we have, I suspect they are disappointed to learn that it is the Longfin Pompano. Can a fish from our own Atlantic coast be considered rarer than one from, say, the coral reefs of far-away Ceylon? The answer is: Yes.

Longfin Pompanos don't look exotic. Grace and beauty they have in abundance, but they lack the flashing colors of the butterfly fishes and the fantastic shapes of the lion fishes or frogfishes. Nevertheless, the fact remains that these are the first Longfin Pompanos the Aquarium has had for many years. We would be hard put to replace them, for it took a very special set of circumstances to get them safely into our tanks.

Although Longfin Pompanos have been caught as far north as Massachusetts, they are rare north of Virginia and do not seem to be common outside of tropical or subtropical waters. Some authorities list them as pelagic, that is, as inhabitants of the open sea — and indeed they may well be, since several of their relatives, the jacks, are blue-water fish — but they are best known inshore where they race along sandy beaches just beyond the breaking waves, or dodge among boulders and rocky debris as little as ten feet from shore. Their agility is extraordinary. Unless you have a net large enough to encompass the whole area, trying to catch Longfin Pompanos is a tantalizing, exhausting and fruitless task.

Catching them, however, is considerably less than half the battle that must be fought until they are established in captivity. Like most fast-

swimming, always-on-the-move fish, they "fight" the net, frantically trying to swim through it, and like most silvery species they appear to be especially prone to injury and sensitive to any sort of handling, particularly out of water. Moreover, when first put into any but the largest of containers, they swim headlong into its sides as if they do not recognize that such things as walls exist. It does not take long for these self-appointed battering-rams to do themselves irreparable harm. The nervous temperament of the species is easily demonstrated — even in specimens that are thoroughly acclimated to life in captivity. Most aquarium fishes soon learn to pay no attention to visitors who tap on the glass or try to attract them by waving hands, hats, pocketbooks, handkerchiefs and the like. Not so our Longfin Pompanos; after more than a year in the same exhibition tank, they can still be startled into making

These are some of the Longfin Pompanos (Trachinotus glaucus) captured in Bermuda by Dr. Frick and now on exhibition at the Aquarium. After a year in our tanks they are still highly nervous and excitable.

a dash about the tank by waving at them through the glass. Fortunately they never run into one of the walls, as they surely would have done when freshly captured. Instead, no matter how wildly they seem to be swimming about, they are able to maneuver, turning and twisting at top speed, and they never touch the walls of their tank or the other, slower-moving fishes that live with them.

It was the foresight and planning of Dr. Henry Clay Frick, a Trustee of the Zoological Society, that made possible our exhibit of Longfin Pompanos. Dr. Frick has spent many months in and

around the waters of Bermuda, where the species is fairly common. He recognized it as a highly desirable exhibition fish, but realized that freshly caught individuals would never reach New York alive. Some sort of acclimation was needed, and the holding pool that he had constructed at the edge of the sea under a shore-line cliff might do the trick. Here the fish could live under conditions as near to their natural existence as possible without actually being free.

Under Dr. Frick's direction, Longfin Pompanos were seined on one of Bermuda's coral sand beaches and transported as quickly and carefully as possible to the holding pool. There were some inevitable losses, but a few weeks later, when Dr. Carleton Ray of the Aquarium's staff was ready to return from Bermuda with a collection of tropical marine fishes and invertebrates for the Aquarium, a dozen lovely Longfin Pom-

the fish were finally placed on exhibition. We wondered whether they would try to butt their way through the glass front of the tank, but they settled in satisfactorily, if not quietly, at least without any disastrous collisions.

Since that time our Longfin Pompanos have added about two inches to their length, the largest one being slightly more than a foot in total length. This is close to the maximum size reported in nature. The fish are fed nearly every day, but never as much as they would like to eat. Their principal food is the muscle of clams. In nature they are known to eat small fish and worms. An interesting aspect of their feeding behavior is that they will snap up bits of food no larger than a match-head with almost as much avidity as they do much bigger pieces.

Unlike its close relative, the Common Pompano, the Longfin species is not considered an



panos were on hand to make the trip. Especially gentle handling, in addition to the fact that the fish were already accustomed to the walls and corners of limited quarters and to at least some of the strange stimuli of captivity, enabled Dr. Ray to bring all twelve to New York alive. They arrived on July 18 of last year, their ship was met by the Aquarium truck, and they were soon deposited in one of our reserve tanks for further acclimation — this time not only to the Aquarium's style of tank but to a new kind of sea water as well. There were some tense moments when

epicurean delight, although it is regularly sold in the markets of various parts of the West Indies. To us, its good looks and constant activity are much more important than its taste. The falci-form elongation of its unpaired back and belly fins and its deeply forked tail give it a strikingly angular yet completely graceful appearance. Few are the fishes in an aquarium that do not require some special effort to obtain and to hold. The Longfin Pompano took perhaps more than its share, but it represented a challenge that, through Dr. Frick's efforts, we have been able to meet.



Zoo News in Pictures



Natural history can provide many examples of astonishing similarity of color, pattern, behavior and the like among quite unrelated animals. This snake is such an example. It is the **GREEN PYTHON** of New Guinea and northern Australia and in its color and markings and method of draping itself on a limb it is remarkably like the Emerald Tree Boa of South America. To make the similarity even more striking, the young of both snakes are a bright brick red.



Each fall at leaf-burning time this interesting behavior can be seen on the African Plains. A female **SOUTH AFRICAN OSTRICH** is immediately attracted when the keeper sets fire to a pile of leaves and usually approaches the blaze, crouches over the flames or glowing embers and rolls her wings and body from side to side. Presumably her actions are connected with the "anting" and sunning often observed in other birds. This same ostrich, incidentally, is the one we pictured taking a bath in the Waterhole on the African Plains, in the September-October issue of *ANIMAL KINGDOM* last year. The male **MASAI OSTRICH** on the Plains shows little interest in the burning leaves and has not been seen to hover them.

PHOTOGRAPHS BY SAM DUNTON

These homely but engagingly friendly little monkeys from the forests of Brazil are **RED-FACED UAKARIS**. Their hair is a rich dark red, their faces bright red. We have never observed it in our pair, but those red faces are said to turn even brighter red when the monkeys are excited. At the moment this pair is living comfortably in the Animal Hospital, but will move into the Monkey House when the building is completed this fall.





Latest portrait of our three young **JAGUARS**, born on June 24. Keeper Fred Martini can tell them apart at a glance, and asserts that they are quite different in appearance. There *does* seem to be some small variation in markings and perhaps in expression, but . . .

Photograph by Nat Fein, Herald Tribune



Admittedly it's an awkward pose but much can be forgiven a **REINDEER** calf only a few weeks old. This bull calf was born on May 12. His father has a magnificent set of antlers but unfortunately they are likely to be dropped just shortly before Christmas.



MOSCOW GARDEN

Through this imposing main gateway more than 3,000,000 persons each year enter the Moscow Zoological Garden. The park also has a library, laboratories and an Aquarium.

Sovfoto by S. Khizhniak

Oldest Zoo in the Soviet Union

By I. SOSNOVSKY

Director, Moscow Zoological Garden

WINTERS IN MOSCOW are often severe, with cold winds, heavy snowfall and frosts during which the temperature drops to 20° below zero Fahrenheit. In summer there are heat waves when the thermometer stands in the mid-eighties for days on end. But no matter what the weather there is never a day without its visitors to the Zoological Garden.

Some three million people visit the Garden annually. The Garden has a rich and varied collection of vertebrates from all parts of the world. Altogether, it has about 3,000 specimens representing 550 zoological species.

The Moscow Garden is the oldest zoo in the

Soviet Union. It was founded in 1864 by the Russian Society for the Acclimatization of Plants and Animals at the initiative of biologists and undergraduates of Moscow University. After the October Revolution it was proclaimed the property of the people by a special decree of the Soviet Government.

A visitor to the Garden may, after making a tour of the grounds, view a popular science film, attend a lecture, obtain answers to any questions he may have about the specimens on display or visit one of the natural science exhibitions that the Garden organizes regularly.

The Garden gives students of zoology in sec-

ondary and higher schools a great deal of assistance. Younger children are shown how to set up plant and animal rooms at school, as well as how to care for animals, observe their habits and so on.

Now let us make a tour of the Garden.

The sound of tinkling bells as we enter the grounds guides us towards the Ring. There children are having a glorious time riding donkeys and ponies. Next to the Ring are two ponds where weeping willows trail their branches in the water. The ponds are the home of white and black swans, pelicans, geese and a large number of ducks. In spring, towards the end of May, the ponds and their banks are covered with fluffy yellow ducklings, gray baby swans and red-headed water hens. The ponds provide them with a plentiful food supply and they grow rapidly.

In winter holes are cut in the ice in the ponds so that the birds can swim and bathe even when it is very cold. The wings of the wild ducks are not clipped, and they fly about freely all year 'round. Visitors often ask why they do not go south in autumn. It is evidently because they have plenty to eat in the Garden. Birds fly to a warmer climate because food grows scarce, not because they are afraid of the cold. The birds at

the Garden have grown accustomed to Moscow conditions and have ceased to be migratory.

From the ponds we move over to the cages where the birds of prey, the eagles, vultures, eagle-owls, bald eagles and Kuzya the condor, our oldest resident, are kept. Kuzya will this year celebrate the 65th anniversary of his arrival at the Moscow Zoo, to which he was brought already full grown. He must be at least 75 years old but is healthy and looks like a young bird.

A flight of stone steps brings us to the top of Elephant Hill, where the Indian Elephant Shango, more than ten feet high, strolls about inside a big enclosure. Shango has lived at the Moscow Garden for upwards of twenty years. He has fathered two sons that were born at the Garden. The first was Moskvich, born of Molly,

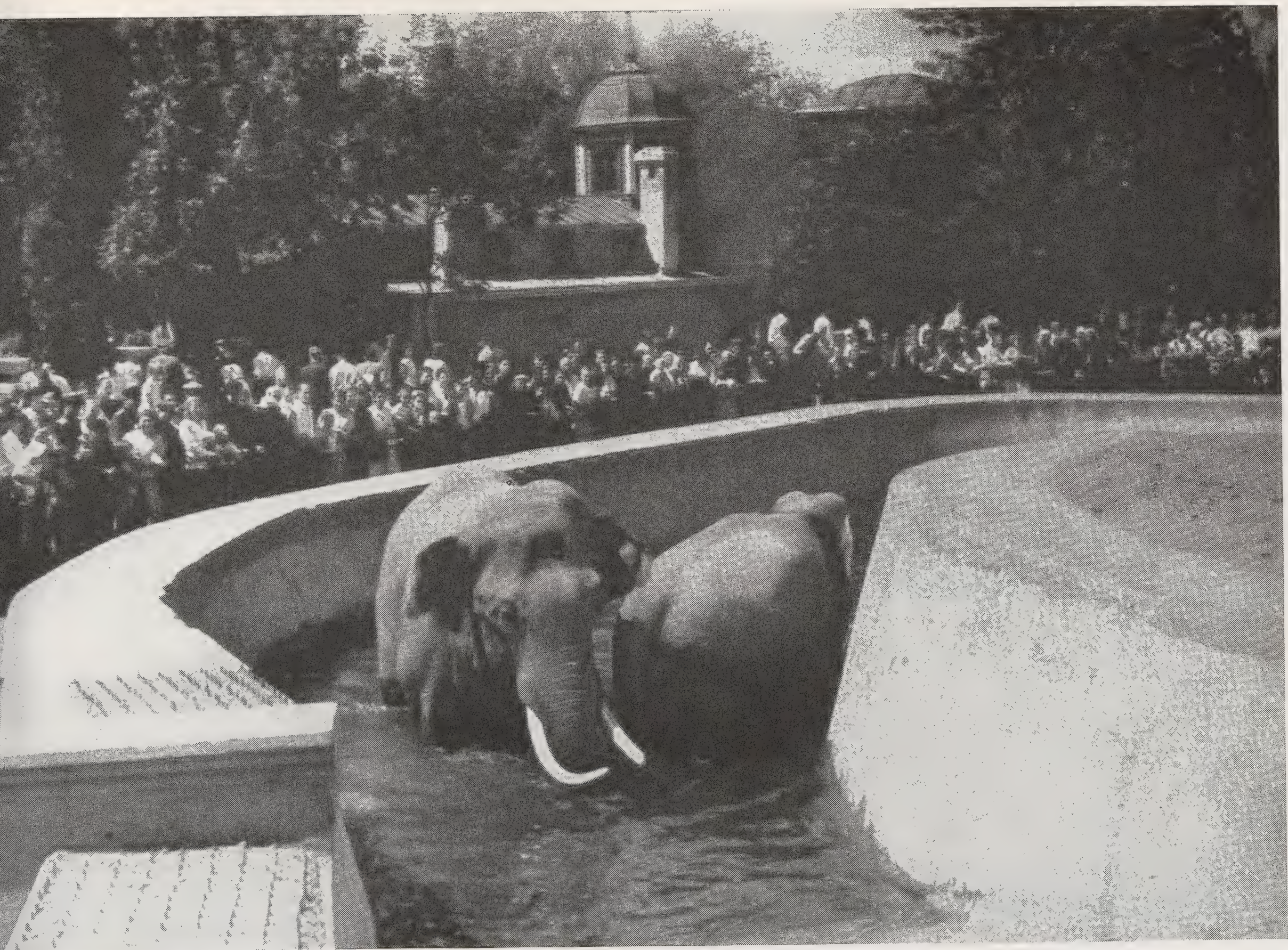
Shango, a 10-foot Indian tusker, is the father of two baby elephants in the Moscow Zoo since 1948. Elephant births in captivity are quite rare

Sovfoto

The Andean Condor named Kuzya holds the longevity record in the zoo. It is estimated to be 75 years old and has been in the Moscow Zoo 65 years.

Photo by A. Anzhanov





Shango's mate, in 1948. The second was born in 1952. Both are now full-grown and have been sent to other zoological gardens in the Soviet Union. Shango eats about 300 pounds of food daily. His diet includes hay, sugar, bread, apples, potatoes, cranberries, cabbage, tree branches with the dried leaves on them and many other items.

The Aquarium at the Garden has a large collection of river, lake and ocean inhabitants. Of the fish found in the Soviet Union the most interesting is the Beluga or White Sturgeon. It requires a great deal of care in captivity. The flesh of the Beluga has a pleasant flavor and is nourishing; it is particularly valuable because of its roe.

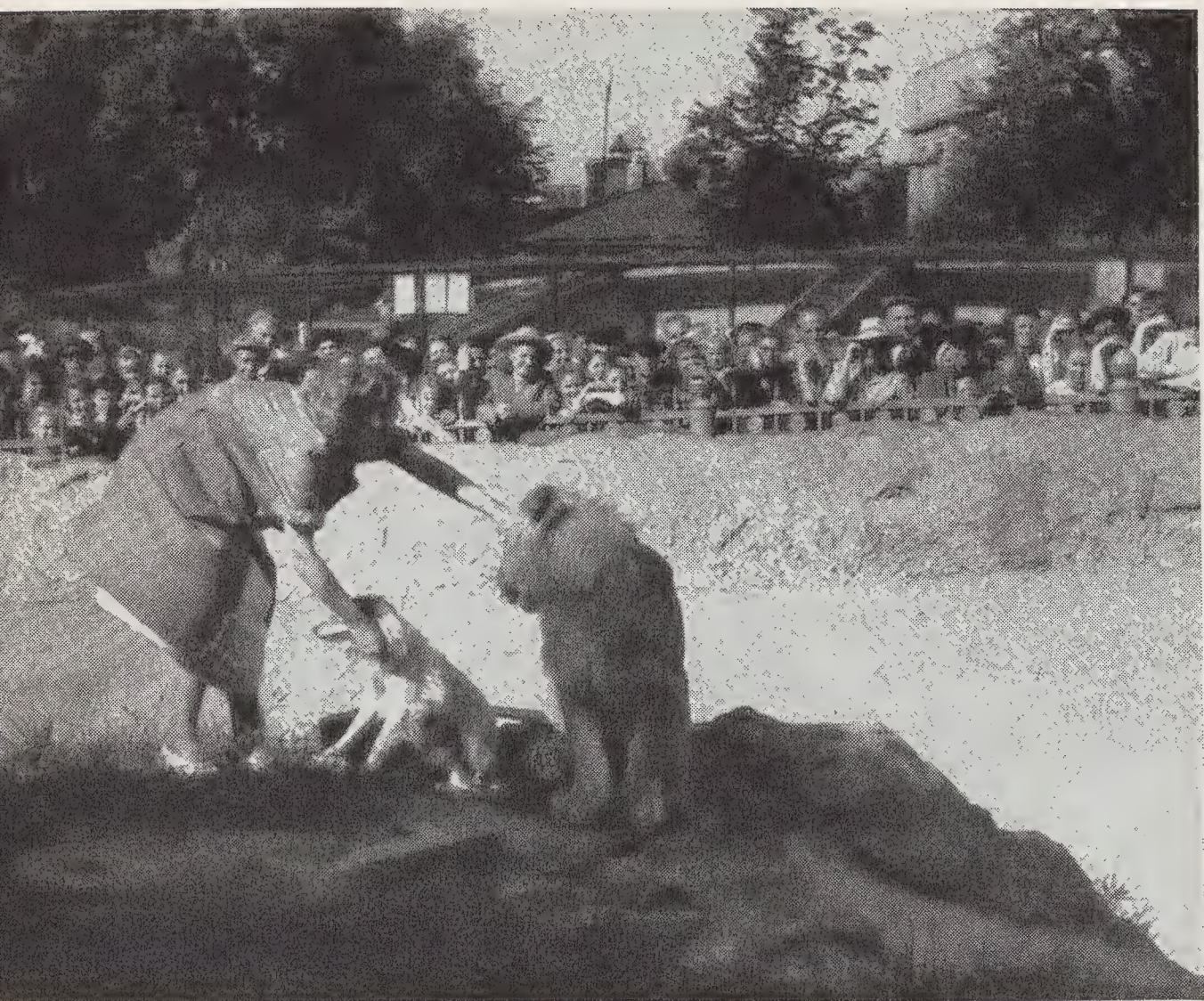
The Beluga lives in the sea but breeds in the rivers, travelling hundreds of kilometres to spawn and then returning to the sea. Because the Soviet Union's Beluga resources are not large, research workers at the Garden have for several years been studying this fish and the conditions under which it can be bred in captivity, the aim being to breed

Beluga in fresh-water ponds and lakes. Some progress has already been made. Specimens of Beluga have lived in the Aquarium for more than five years and are growing well.

It is always crowded about the big outdoor pool used by Malyshka the Walrus. Malyshka was brought from the Arctic several years ago when he was so young he did not yet know how to eat properly. When the baby Walrus was ill for a long time and refused to eat, the Garden veterinarians and zoologists nursed him back to health. Today Malyshka is a large, strong, playful animal weighing all of half a ton. He puts away some 40 pounds of fish for his dinner.

The Walrus is constantly in motion, swimming and diving. His toys include a big wooden ball and an inner tube from which he refuses to be parted. He is so accustomed to his keepers that when they call he quickly climbs out of the water and follows them like a devoted dog, growling constantly to show his pleasure.

But the gayest place in the Garden is the Cubs'

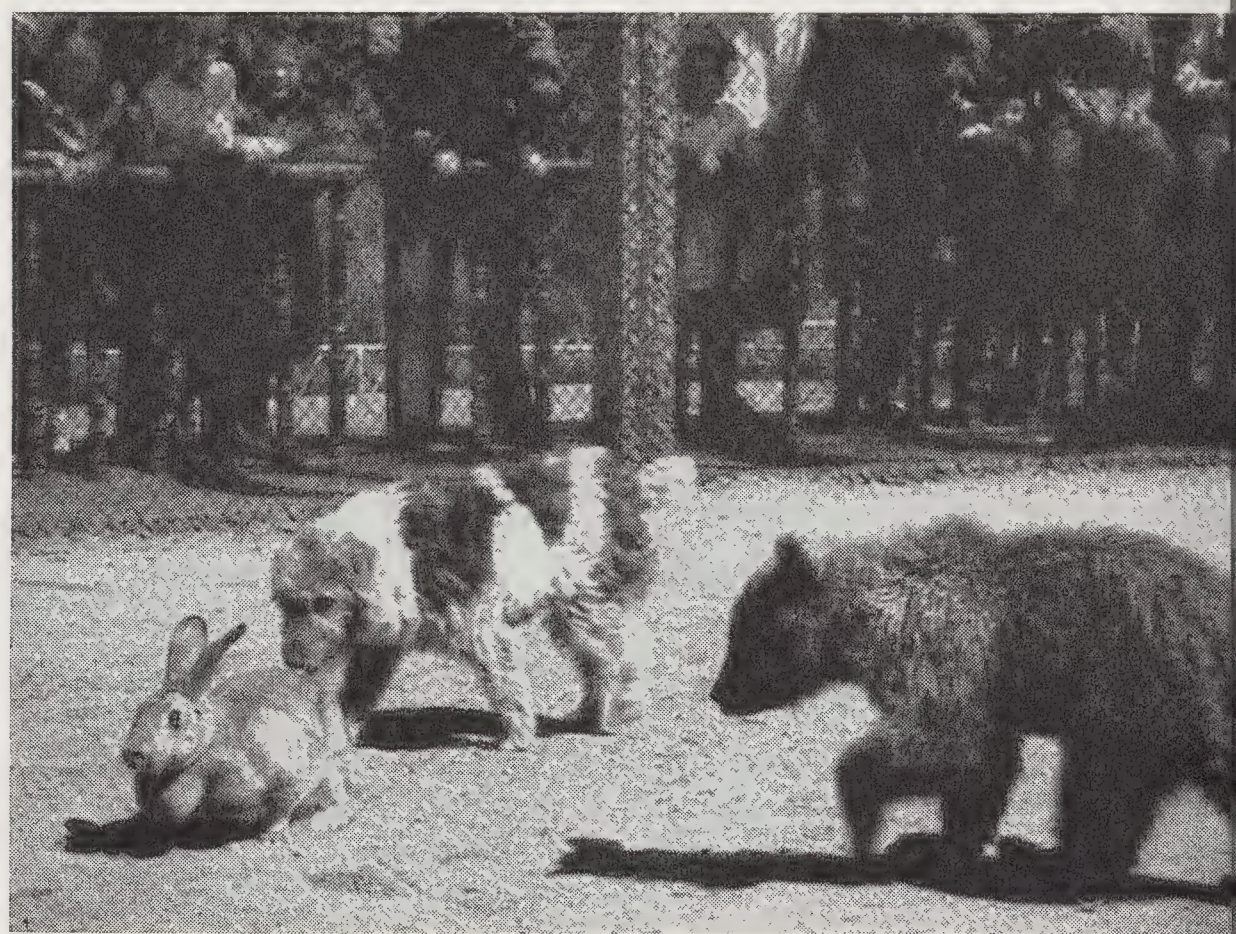


Tobik and Chandr, a dog and a lion, were reared together and are close friends. The lion, fully-grown now, must be kept in a special enclosure.

Sovfoto by B. Kozlov

The most unlikely associates may be found playing together in the Cubs' Corner each spring. Later most will be sent to other zoos or circuses.

Photo by A. Anzhanov



Corner, a "kindergarten" organized each spring from the baby animals in the zoo. There baby bears, foxes, goats, wolves, lions and pigs live together through the summer. The laughter of children leads us straight to the Cubs' Corner. Even adults have to smile at a bear cub wrestling with a baby pig, white bear cubs playing in the water, a baby fox ringing a bell or wolf cubs chasing a football.

The cubs seldom fight. They may be natural enemies, but in the Cubs' Corner they are friends. After dinner they all take their naps huddled close together, perhaps with a pig's snout sticking out beneath a bear cub's paw, a wolf cub with his head pillowed on a kid and a fox cub cuddled up to a lamb.

When the cubs grow older some are sent to other zoological gardens. Others go to circuses, still others continue to live together for a long time. Chandr, a tremendous lion, and Tobik, a little dog, have been close friends for ten years. This unusual pair has many friends among Moscovites, who visit them regularly.

The two buildings near the "kindergarten" house a scientific library and a laboratory where the diseases of wild animals are studied. The library contains a large collection of books and magazines on zoology, veterinary medicine and geography in Russian and other languages. It is used by specialists at the Garden and workers at other establishments in the country. Kept in the library are volumes of articles by Moscow Zoo re-

search people concerning the biology of wild animals. The latest volume came out in January, 1958, and was sent to many zoological gardens abroad.

Work in the laboratory is devoted to studying the diseases from which wild animals suffer and ways of preventing and treating these diseases. Research at the zoo is of major importance not only for the zoo itself but also for other branches of the national economy, such as livestock breeding, hunting and trapping and fur farming. Study of wild animal diseases and methods of treating them has reduced mortality among the animals at the Gardens to a considerable degree. There are swans, bears, panthers, tigers, monkeys, antelopes, emus and other birds and animals that have lived there for upwards of a quarter of a century.

Last year some 75 species produced young at the Moscow Garden. They included jaguars, tigers, hippopotamuses, tapirs, llamas, monkeys, black swans, salamanders, snakes, kangaroos, tortoises and zebras.

In the section where the larger beasts of prey are kept, the Giant Panda, a rare animal known as the bamboo bear, found only in one district of

China, is of particular interest. There are specimens of Giant Pandas in the zoological gardens of Peking and Moscow. Moscow's panda, called "Pinia," was presented to the Moscow Garden last year by the mayor of Peking. It is remarkably gentle and affectionate. It has black and white fur and big black rings that look like horn-rimmed glasses about its eyes.

We were told when we got the panda that it lives chiefly on bamboo shoots and leaves. A supply of these accompanied it. When the supply ran out we obtained bamboo shoots from the Black Sea coast. But after winter set in no more shoots were forthcoming. Workers at the Garden analyzed a large number of plant foods and gradually offered them to the panda in place of bamboo shoots. Now this rare animal consumes rice porridge, apples, carrots, milk, and fruit juices, and feels fine.

Hippopotamuses have done very well here and a breeding pair has been producing young regularly since 1942. Some 75 species reproduced last year, including hippopotamuses.

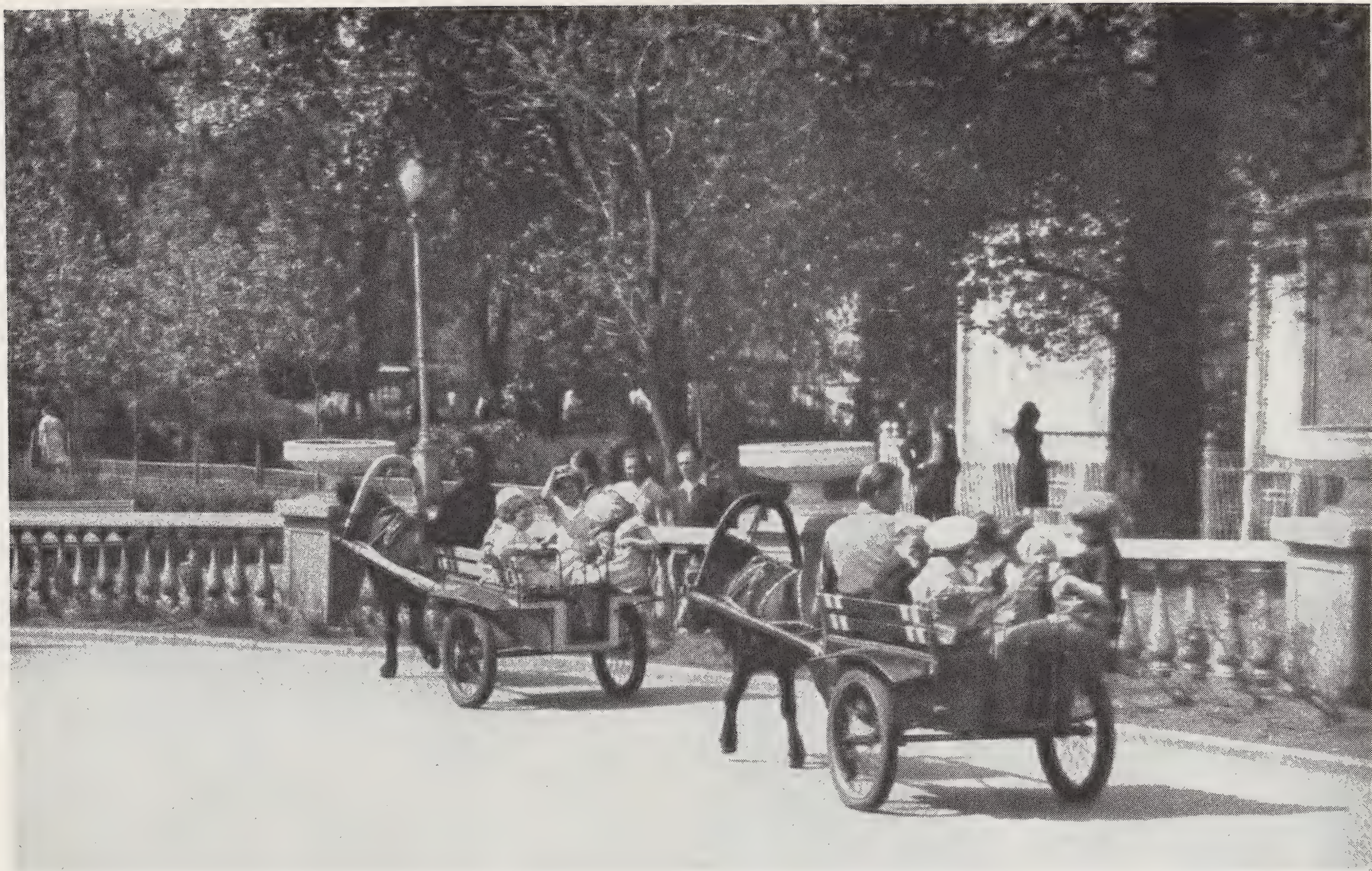
Sovfoto by S. Khizhniak

From the beasts of prey the path takes us to the monkey house. The monkeys are the zoo's most restless inhabitants. They are forever on the move and always busy — breaking up their feeding troughs, picking locks, unraveling nets, and taking apart their toys. They never settle down, even at night.

The three Chimpanzees and two Orangutans have a house to themselves. The oldest of them is the Chimpanzee Paris. He came to us more than twenty years ago and will soon be twenty-five years old. Although Paris has gone quite gray he is completely healthy and very energetic. He knows many of the park attendants and easily picks them out of a crowd of visitors. Paris dislikes strangers. But he likes wine. He developed a taste for it when he caught cold and was given some as medicine. Since then he has never refused a glass when it is offered him.

The monkeys are constantly under the observation of research workers studying the higher nervous activity, diseases common to both human beings and animals and other biological problems.





A big stone building that looks something like a hill surrounded by deep ditches houses the bears, wolves, hyaenas and tigers. Two enormous Ussuri Tigers named Amur and Alpha advance towards us, but there is no need to be frightened. They cannot leap across the ditches. The only part of the Soviet Union where Ussuri Tigers are found is the Far Eastern regions. These tigers are preserved by the state. They do man no harm and have never been known to attack a human being.

Beside them is a cage containing a pair of tigers from tropical Asia. They breed well and produce three or four cubs every year.

Then come species from America, skunks and raccoons and rattlesnakes in the terrarium. They came to us from the San Diego Zoological Garden in 1956. Not long ago we sent two lynx to San Diego. They stood the journey by air well and arrived safely.

In the fur-bearing animals' section there are martens, squirrels, polecats, hares, marmots and other animals, including the sable, pride of the Moscow zoo. These valuable animals were bred in captivity in the Soviet Union, for the first time in the world, in 1929. Before that could be accomplished a thorough study had to be made

Tinkling bells attract young visitors to The Ring and here they ride on donkeys and ponies or jog around the circle in miniature carts.

Photo by A. Anzhanov

of this little-known beast of prey. There are now sable-breeding farms. A systematic study is also being made at the Garden of other fur-bearing animals and game birds.

In the heart of the Garden there stands an attractive little house where the junior biologists' club holds its meetings. The members of the club come to the zoo after school to make observations of the animals, study their habits and help the zoo attendants look after them. In every way the Garden assists children who display an interest in biology. During the winter and summer school holidays the club members go on excursions, thereby getting used to the camping they will have to do on real expeditions, make collections and catch lizards, rodents and birds for the Garden. Every summer a group of older children go to a preserve where they study flora and fauna during the course of the summer.

The junior biologists' club has existed for more than thirty years. Many of its former members, great nature lovers, have become outstanding scientists, teachers and authors.

But They All Smell Like Skunks . . .

By RICHARD G. VAN GELDER

*Acting Chairman and Assistant Curator, Department of Mammals,
American Museum of Natural History*

IMAGINE A MIXTURE of strong ammonia, essence of garlic, burning sulphur, a volume of sewer gas, a vitriol spray, a dash of perfume musk, all mixed together and intensified a thousand times." This description of a skunk's scent came from the pen of the famed naturalist Ernest Thompson Seton, a mephitophile who once spurned the thought of eating a skunk because it was "too much like eating a baby." It probably comes as close as words can come to conveying an impression of the skunk's defensive weapon. Fortunately there are other and pleasanter aspects of the animal's life history.

Skunks are strictly a New World product and they are found from northern Canada to the Straits of Magellan, and from the Atlantic to the Pacific. They occur from sea level to an altitude of 13,000 feet, in habitats that range from desert to forest.

Here in the northeastern United States we know only one skunk, the common Striped Skunk that occasionally visits suburban backyards at night in search of grubs, larvae, insects, field mice and the like. But there is actually a pleasing variety in the subfamily Mephitinae of the family Mustelidae; three genera or divisions whose members among them cover much of North and South America and differ rather widely in size and appearance and to a lesser extent in habits.

But they all smell like skunks.

The spectacular Hooded Skunk of our southwestern states is one of the least-known of American mammals. Its name comes from the cape of white fur typical of one color phase.

John J. Stophlet from National Audubon Society





To sort them out a little, the three genera are *Mephitis*, which includes our Striped Skunk and the Hooded Skunk; *Spilogale*, which takes in the Spotted Skunk and the Pigmy Skunk; and *Conepatus*, which contains several species and subspecies of the Hog-nosed Skunk.

The Spotted Skunks are regarded as the most primitive of the skunks, largely on the basis of their rather weasel-like appearance. The name "Spotted Skunk" is the scientist's common name for them, but among people generally that name is seldom used and there are at least a dozen local names in various parts of the country — "Polecat" among others. "Civet" or "Civet Cat" are probably the commonest names, although they are not at all appropriate for they properly belong to the Old World members of a different family. In the Southwest the Spotted Skunks are often called "Hydrophoby Cats" or "Phoby Cats," for they are believed to carry rabies. Some of them do carry rabies, but it is not a chronic condition with them and is probably less common among the Spotted Skunks than among the Striped Skunks.

They certainly should not be called cats, for skunks are no more closely related to cats than dogs are.

The Spotted Skunks have the most complex and bizarre color pattern of all the skunks. Six

This is the common Striped Skunk of a large part of the United States. It is a useful animal, for it feeds on larvae, field mice and the like.

Spotted Skunks are the smallest of all. One species on the west coast of Mexico is only ten inches long, the largest less than two feet long.

white stripes, which vary in thickness and length, extend down the forward part of the back and sides, and on the rump they are broken into smaller stripes and spots. In the middle of the forehead there is a triangular patch of white, and the tail (in all but one subspecies) is plumed with white. The variations on this basic pattern are infinite, with one kind having all of the stripes broad and interconnected, and another having virtually no white at all — the stripes being reduced to tiny flecks over the body. No two of these skunks have ever been found with precisely the same pattern. In addition to having the most complex pattern, these skunks are also the smallest of the three kinds, there being one species on the west coast of Mexico which measures only ten inches from nose to tail. Even the largest members of this genus are usually less than two

feet in length. Spotted Skunks are rather weasel-like in habits as well as appearance, for they are active, agile and aggressive. Unweasel-like, they are good climbers and sometimes have their den in a tree.

Surprisingly little is known of the life of the Spotted Skunks. The species that lives in western Mexico (*Spilogale pygmaea*) is known by only four specimens, and all that can be said of it is that one of the four was collected in a trap that was set in the underground burrow of a pocket gopher. This Pigmy Skunk is probably the most primitive of all of the skunks, and knowledge of its habits would be of considerable interest. The bigger species, *S. putorius*, is better known, for it is found over most of the United States and is of some value as a fur-bearer. It is absent from the northeastern United States, and is probably most abundant in the Southwest, although it ranges up into southern British Columbia. A gen-



eral trend in color pattern and size is evident in this species, for the animals are larger and blacker in the north and whiter and smaller in the south, and in southern Mexico and Yucatan there are some races that are almost as small as the Pigmy Skunk.

Just looking at the flamboyant color pattern of the Spotted Skunks gives one the idea that this

is an ideal "warning" coloration. How could anyone not notice such a contrasting pattern? But the fact is that the Spotted Skunks are virtually invisible at night among the rocks where they live. The erratic pattern of black and white stripes breaks up their outlines and when they are not moving they are almost invisible. They *can* be seen when in motion, but still not so clearly as would be expected.

The general habits of these skunks also differ from those of the other kinds in that they are not the bold, temerarious, self-confident creatures that the Striped Skunks are. Weasel-like, they lurk along the edges of rocks and buildings and rarely venture forth from cover. Nevertheless, they do have a warning signal to let the unwary know that they are still skunks — and that is the tail. At the least sign of danger up goes the "flag," and a plume of white cascades down over the black base of the tail. If the warning flag is not sufficient to deter the curious, these skunks may resort to a unique threat — they stand on their hands and sometimes even advance on the on-looker. Few animals or human beings fail to take heed of this warning, at least after the first time.

In the central United States there are Spotted Skunks that are almost totally black on the body and have no white on the tail. Have they placed full reliance on their blackness and given up the white warning signal? Much as this seems unlike the method of evolution, it is apparently the case. The Spotted Skunks in question are the northern members of a subspecies called *Spilogale putorius interrupta*, which is found from the Mississippi River west to eastern Colorado, and from northern Texas to the Canadian border. The southern members of this race have the white markings somewhat reduced on the body as well as on the tail, but it is not until they reach Missouri and northern Kansas that they become very black, and seem to get progressively darker to the north.

It seems now that these skunks are relatively recent invaders into this northern part of the range, certainly since the last glacial period and more likely in the last few hundred years. Prior to the coming of the white man, some of the habitat in the eastern part of the range was unsuitable for skunks because of the high water table, but drainage has created a skunk haven

and homes and farm buildings also provided a habitat that previously did not exist in the prairie. With the settled white man came summer food in the form of crops and a winter supply in the European rats and mice that accompanied civilization. And so, with shelter and year-round food, the skunks spread. Man did one more thing which may have influenced the direction of the skunks' evolution: he eliminated or reduced in number the predatory animals that would prey



on his stock, and which also might have preyed on skunks. If this hypothesis is correct, it would explain to some extent why these skunks, which had a reduced color pattern when they moved into the area, might have headed in an evolutionary direction that has resulted in the almost complete loss of the white stripes and the absence of the white warning tuft of hairs on the tip of the tail.

But it is a complex problem, for all of the northern races of Spotted Skunks have somewhat reduced white markings, and this might be re-

lated to some climatic factors. Certainly these skunks in the prairie states are exposed to as severe a climate as Spotted Skunks anywhere are.

Although little is known of the food habits of skunks, the indications are that the Spotted Skunks are the most carnivorous of the three genera. Their annual food cycle is rather unusual, and the studies that have been made on Spotted Skunks living around farms in Iowa indicate that during the summer most of their diet is made up of vegetable matter, particularly corn, and insects and insect larvae. In the fall, as the weather becomes cooler, the Spotted Skunks begin to kill rats, although they often eat little or none of the carcass. By midwinter they are living almost entirely on rats. In the spring the cycle reverses, and again rats are killed and only partially eaten, and then merely killed, and by summer the Spotted Skunks may be living practically side by side with rats without disturbing them.

Spotted Skunks are reputed to be better "ratters" than cats, and they have been used for this purpose in a number of places. Wise farmers encourage their presence, and they are sometimes domesticated and kept about the house to feed on vermin. In Florida almost a hundred years ago Spotted Skunks were kept for this purpose, and the scent sacs were left intact. One scientist, who enjoyed their antics, nevertheless felt that their presence afforded a dubious pleasure which he likened to "enjoying a cigar in a powder magazine."

Baby Striped Skunks show the characteristic pattern of their kind at birth. Although as adults they may weigh up to 16 pounds, they are minute as babies, weighing about 1 ounce.

Photo by the author

Although Spotted Skunks can climb, they only rarely make their homes in trees and seem to prefer an underground den. Sometimes this den is taken over from a ground squirrel or burrowing owl, in other places it is located in a crevice in rocks or in a hollow log. The only requisites they seem to demand for their den sites are that they be dry and dark. The den does not belong to any one individual but is community property. Except during the breeding season, these skunks wander about over a few square miles and spend the day in any handy Spotted Skunk burrow. At

times seven or eight may be spending the day in a single den. The young have the distinctive color pattern at birth, although their eyes are closed and they are helpless at this time. By one month of age the eyes have opened and the little ones can scramble about. The use of the musk glands is acquired about this time, and at three and a half months they are adult size and venture forth on their own. Generally there are four or five in a litter, and in some areas the females may have two litters a year. The season of birth varies, generally being in the spring, but in the lower latitudes may be at any time.

In marked contrast to the furtive, weasel-like habits of the Spotted Skunk, the Striped Skunk (*Mephitis mephitis*) lumbers confidently about, fearing little and secure in its gaseous defense. Striped Skunks are the most northern of the three species and during the coldest parts of the winter may become inactive for days at a time — although they do not truly hibernate. This is the “common skunk,” and is found almost everywhere in the United States. Much larger than the diminutive Spotted Skunk, Striped Skunks may be up to 32 inches in length and weigh as much as 16 pounds — although 8 to 10 pounds is considered heavy. At birth the young of Striped Skunks weigh about an ounce.

The color pattern of the Striped Skunk is quite different from that of the Spotted. It is highly variable, but is based on a reduction or expansion of two white stripes that extend backward and outward from a white bar at the base of the skull. In some animals the stripes are so broad that it seems that there is only a single, wide white stripe down the back; in others the only remnant of the stripes may be a small V-shaped patch on the neck. The tail, too, varies from almost totally black to almost pure white. As in the Spotted Skunks, the animals from the more northerly parts of the range seem to be larger and darker than those from the southern areas.

In food habits the Striped Skunks seem somewhat more omnivorous than their smaller cousins. Most of their diet is comprised of insects, fruits and berries, although they sometimes kill and eat small rodents. Carrion and eggs also make up a good part of their diet. One classic example of the interrelationships of the biotic world centers around skunks. A marsh in New York State had

a large duck population as well as many skunks. During a period of demand for skunk fur, the skunks were intensively trapped. Because skunks sometimes eat duck eggs, it was thought that the ducks would increase, if they changed in numbers at all, as a result of the decrease in the number of skunks. Instead, the duck population went into an immediate decline. Investigation revealed that the skunks had been *aiding* the duck population, for the marsh also abounded in Snapping Turtles. The skunks dined often on the turtle eggs, and when the numbers of skunks were reduced by trapping, the turtle population increased and its unrestrained depredations made it virtually impossible for the ducks to raise any young. When the price of skunk fur declined, the natural equilibrium was reestablished.

A close relative but different species of the Striped Skunk is *Mephitis macroura*, the Hooded Skunk. This is the southern representative of *Mephitis* and is found from New Mexico and Arizona south through Mexico and Central America as far as Honduras. It is a creature of arid lands and is characterized by its relatively long tail, slight build and distinctive color pattern, as well as technical features of the skull. There are two color phases of the Hooded Skunk, and apparently both can occur in a single litter. In one phase the animal is completely black on the back and has a white lateral stripe on each side; in the other the animal is almost wholly whitish above, with a broad cape of intermixed, long, black and white hairs which gives the species the name “Hooded.” So little is known of the habits of this species that Seton, who devoted 55 pages to the Striped Skunk in his “Lives of Game Animals,” wrote only a dozen lines on the habits of the Hooded Skunk and merely said that they were much like those of the Striped Skunk. Roots and fruits have been found in the stomach of one Hooded Skunk, and from the signs of a parasite that infects them, it seems also that they sometimes eat snails.

Hooded Skunks, then, are one of the least known of the American mammals. Of particular interest would be a study of their ecologic relations to the other skunks, for in most of their range they occur together with Spotted and Hog-nosed Skunks, and in the southwestern United States also with the Striped Skunk.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Grants to the Society, and by the Society, Are Announced

The Zoological Society's Genetics Laboratory under Dr. Myron Gordon has received a grant of approximately \$150,000 from the National Cancer Institute of the Public Health Service for continuation of research in the genetics of melanoma. The grant includes \$26,000 a year for five years, starting January 1, 1960, and additional sums for salaries and equipment for 1958 and 1959.

The Genetics Laboratory has also been given a two-year grant totaling \$12,000 from the National Science Foundation for a continuation of work on the biological synthesis of the poeciliid fishes.

On the other side of the ledger, the Zoological Society and the Conservation Foundation have made a grant to Dr. Frank Fraser Darling to cover part of his expenses while making an ecological survey of the Mara and adjacent regions in Kenya for the Kenya Wild Life Society. The Society has also made a grant to enable Noel Simon, chairman of the Kenya Wild Life Society, to attend the 1958 meeting of the International Union for Conservation of Nature and Natural Resources in Athens, and a grant in support of Oliver Milton for a fauna survey of Burma with a view toward the establishment of a national park.

IN BRIEF

And Still Growing. It will take a few more years, but it appears we are likely to have a magnificent pair of Elephant Seals. When they came to us on June 25, 1957, the small male was having feeding difficulties and was given a home of his own in the Seal Pool adjoining the Penguin Pool, while the somewhat larger female was considered able to hold her own among the other animals in the Sea Lion Pool. Early in September

it was decided to put the two Elephant Seals together, and in the course of moving the female we discovered that she now weighs 930 pounds, a gain of 305 pounds in about 14 months. The two animals are obviously happy in each other's company and are much more active now that they are reunited.

King Cobra Growth. Among the many things not known about King Cobras until our breeding pair laid eggs in 1955, 1956 and 1957 was the rate of growth of the young. We gave away most of the 39 young cobras that hatched between July 10 and 14, 1957, and have managed to rear one ourselves. On emerging from the egg it was 16 to 18 inches long; on its first birthday it was 5 feet long.

Platypus Report. Since their arrival from Australia on June 7, the three Platypuses have become accustomed to their new home and to daily exhibition. Patty, the oldest of the two females, has adjusted least well; she is still inclined to refuse to eat if unsettled by any incident, such as handling. Paul and Pamela have presented few difficulties and are gaining weight. At their last weighing, on August 6, Paul's weight had increased from 2.55 to 3.344 pounds, Pamela's from 1.58 to 1.65 pounds. Patty weighed 1.826 pounds, a slight increase over her arrival weight.

Darwin Centennial. A paper by Dr. Oliver on Darwin's contributions to bio-geography was presented *in absentia* as part of a symposium on "Darwin's Impact on Modern Biology" at a meeting of the Society for the Study of Evolution, in Ann Arbor, Mich., in August.

Great Black Woodpecker. The largest woodpecker in Europe — fully equal in size to our Pileated — is the Great Black. It has been many years since we had a specimen, but now we have an excellent one on exhibition on the west side of the Bird House.

The President of the New York Zoological Society admits to a "bowing acquaintance" with whales in the past, but this is the first time he has shaken hands with one. The scene is Marineland of the Pacific, at Portuguese Bend, Calif. Looking on are David Brown, Director William Monahan, and Mrs. Osborn. The animal extending a cordial fin is the Pilot Whale called Bubbles."



Wild Ruminant Regulations. As President Osborn set forth in the July-August issue of *ANIMAL KINGDOM*, a bill had been proposed in Congress which would have prohibited zoological parks from importing ruminants and wild swine. Vigorous protests were made by many zoological parks and in the end the legislation was modified to permit importations and exhibition under regulations of the Department of Agriculture.

Moloch Lizards. Last year for the first time we exhibited the bizarre Moloch Lizards (*Moloch horridus*) from Australia, which feeds exclusively on ants. Now we have received three more specimens and they are on exhibition in the Reptile House.

Parakeet Tumors. In the past two years Dr. Gandal has developed a successful technique for the surgical removal of tumors in parakeets and a one-reel motion picture of the operation has been made by Staff Photographer Dunton. The film was shown for the first time at a meeting of the American Veterinary Medical Association in Philadelphia in August.

39 Rhinoceros Vipers. The Rhinoceros Viper (*Bitis nasicornis*) of Africa is not rare in zoological collections, but it seldom lives very long. We had two broods of young born during the summer, a total of 39 heavy-bodied little snakes, and are hopeful that some of these captive-born individuals can be reared to maturity. Several have

shown a ready willingness to eat. Oddly, all of them shed their skins within a few minutes after birth. Twenty-four specimens have been given away to the zoos in Philadelphia, San Diego, Staten Island and Washington, D. C.

Father of the Herd. During the summer it was necessary to destroy our old Formosan Deer buck which came to us in 1946 from the Duke of Bedford's estate in England. He had sired all but one of the Formosan Deer in our herd (the exception is a female that came in 1943) and presumably he is the forebear of all the Formosan Deer in this country, for there was no breeding pair in any American Zoo when he arrived. We have since disposed of 19 surplus animals to other zoos.

PUBLICATIONS OF INTEREST

THE WARBLERS OF AMERICA. Edited by Ludlow Griscom and Alexander Sprunt, Jr. 356 pp., 33 color plates, numerous black and white illus. by John H. Dick. The Devin-Adair Company, 23 East 26th St., New York 10, N. Y. \$15.

This is the first book to present the Wood Warbler family as a whole. Its reading should provide easing exercise for the painful cases of "warbler-neck" which afflict so many bird enthusiasts each spring and fall. As editors, Griscom and Sprunt are well qualified to constitute present-day warbler sovereignty. The roster of contributors, too numerous to mention, reads like a Who's Who of ornithology and a section presenting notes on the contributors is of interest. A series of general chapters cover classification, study, song, distribution, etc. Sixty forms breeding in the United States, Canada, and Baja, California, are covered in detail with maps illustrating the breeding range of each. These ac-

counts, thirty-one written by Sprunt, are followed by short chapters presenting a view of the remaining warblers from Alaska to South America. The treatment of subject matter may have suffered somewhat from oversimplification for the lay reader. There is a suggested reclassification of the warblers by Griscom which might better have been published elsewhere. The species are indexed but no subject index or general bibliography are included.

The color illustrations of 90 warbler species by Mr. Dick are a major contribution of the book. Many of the Central and South American forms have not previously been illustrated in color. In general, the plates are decorative and good. Several are less successful, especially the worm-eating warbler, ovenbird and water thrush plates, which are too green.

This is an elaborate book which many bird students will find enjoyable and useful. — W. G. CONWAY

ANIMALS IN MOTION. By Eadweard Muybridge. Edited by Lewis S. Brown. 183 plates, including some 4,000 photographs. Dover Publications, Inc., New York, 1957. \$10.00.

A selection of plates from the original 11-volume work, "Animal Locomotion," published in 1887. Muybridge's sequences of high-speed photographs are as fascinating — and as useful, particularly to artists — today as they were 70 years ago. This selection by Lewis S. Brown of the American Museum of Natural History includes the gaits of the horse, the motions of 10 other domesticated animals (the elephant among them), 15 wild mammals and 7 birds. — W. BR.

FIRST DAYS OF THE WORLD. By Gerald Ames and Rose Wyler. 48 pp. Illustrations in color and black-and-white by Leonard Weisgard. **THE FIRST PEOPLE IN THE WORLD.** A companion book by the same authors and illustrator. Harper & Brothers, New York, 1958. \$2.95 each.

Simplified but not written-down accounts of how scientists believe the physical world came into being, and how plants and people and other animals evolved. The text, by two writers experienced in making vast subjects comprehensible to the young, will satisfy intelligent children, and the dramatic illustrations will set them dreaming. — W. BR.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1958)

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Something to crow about in the Children's Zoo?

EVER SINCE Deacon, grand old man of the talking crows and as companionable a bird as ever lived, departed this life in August, 1957, at the age of 14½, the Children's Zoo has sought a replacement in vain. Not that other crows were not available, and fairly good crows at that, but somehow or other they didn't have that ebullience the Children's Zoo had grown accustomed to in Deacon. A succession of candidates was tried but only one came near qualifying: Franklin, a perky customer from Herkimer County. But Franklin never could seem to say anything that sounded like "Hello." And this summer's resident crow, Gorgeous George, turned out to have some black in his nature too, and treated himself to a nip at a tempting finger too frequently.

But it looks now as if the Children's Zoo Zooperintendent, Corrine Dalsgaard, and her enterprising staff have found the bird they want. Raffles is young, foolish, inattentive and errant, but he's cordial, observant, and teachable, just the way you'd want a crow of only five months to be. Besides, he's a splendid physical specimen and knows it. By next Spring, if our Zooperintendent can wheedle *her* Superintendent into allowing Raffles to



live in her apartment, it's a good bet that he'll be as fitting a chairman of the Children's Zoo's welcoming committee as Deacon used to be.

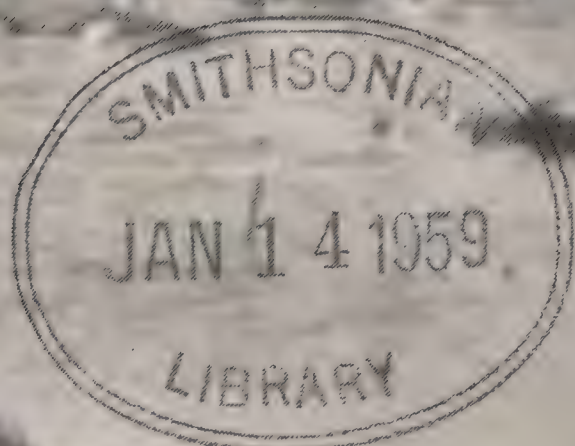
Perhaps (many would say surely) it's too early to crow about Raffles' potentialities, but we'll fly straight into the face of superstition and say we think Raffles is great. We think you will too, if you'll come to the Children's Zoo before it closes for the winter (November 11) and cultivate his acquaintance.

And by the way, since we're talking about prospects, won't you bring one or more prospective members with you when you come, and sign them up for Membership in this Society then and there?



ANIMAL KINGDOM

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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Vol. LXI **DECEMBER** **No. 6**
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Issued bi-monthly at the Offices of the New York Zoological Society, 30 East Fortieth Street, New York 16, N. Y. Editorial and Subscription Offices, Zoological Park, Bronx Park, New York 60, N. Y. Title registered with United States Patent Office • Subscription, \$3.50 a year; single copy, 60 cents. Same rates for all foreign countries and Canada. All pictures not otherwise credited are from the photographic collection of the New York Zoological Society.

Protection of Wild Animals

ONE OF OUR IMPERATIVE PURPOSES, past and present, is that of encouraging measures for the protection of wild animals in their natural environments. Fifty years ago, in its earliest years, our Society soon scored a notable record of accomplishment in preserving threatened species in the United States. The success attained in recent decades, through the concerted efforts of many organizations, including our own, is remarkable because it can now be said that, with a few exceptions, the future of the fauna of our country is more secure than at any time within the last century.

This condition, however, is far from true in many other parts of the world. Presently the threat against many species of mammals and birds in Asia, in Africa and in parts of the Western Hemisphere, is critical to a degree. There are, for instance, major threats to certain species even in Alaska. It is obvious that truly effective work by an institution such as ours cannot be spread on a worldwide basis. Consequently, we have been concentrating on certain key areas where we believe our Zoological Society could make the most effective contributions. Alaska is a case in point; our interest there goes back ten years and includes a basic study by the Conservation Foundation and informative surveys by such outstanding men as Starker Leopold, Fraser Darling and Olaus Murie. Within the last two years we have been expending our energies principally upon the problem of preserving wildlife in East Africa, where the situation is especially acute. At the same time we have been gathering information about the status of wildlife in that vast continent as a whole. In this issue there appears the first of a series of articles concerning this subject.

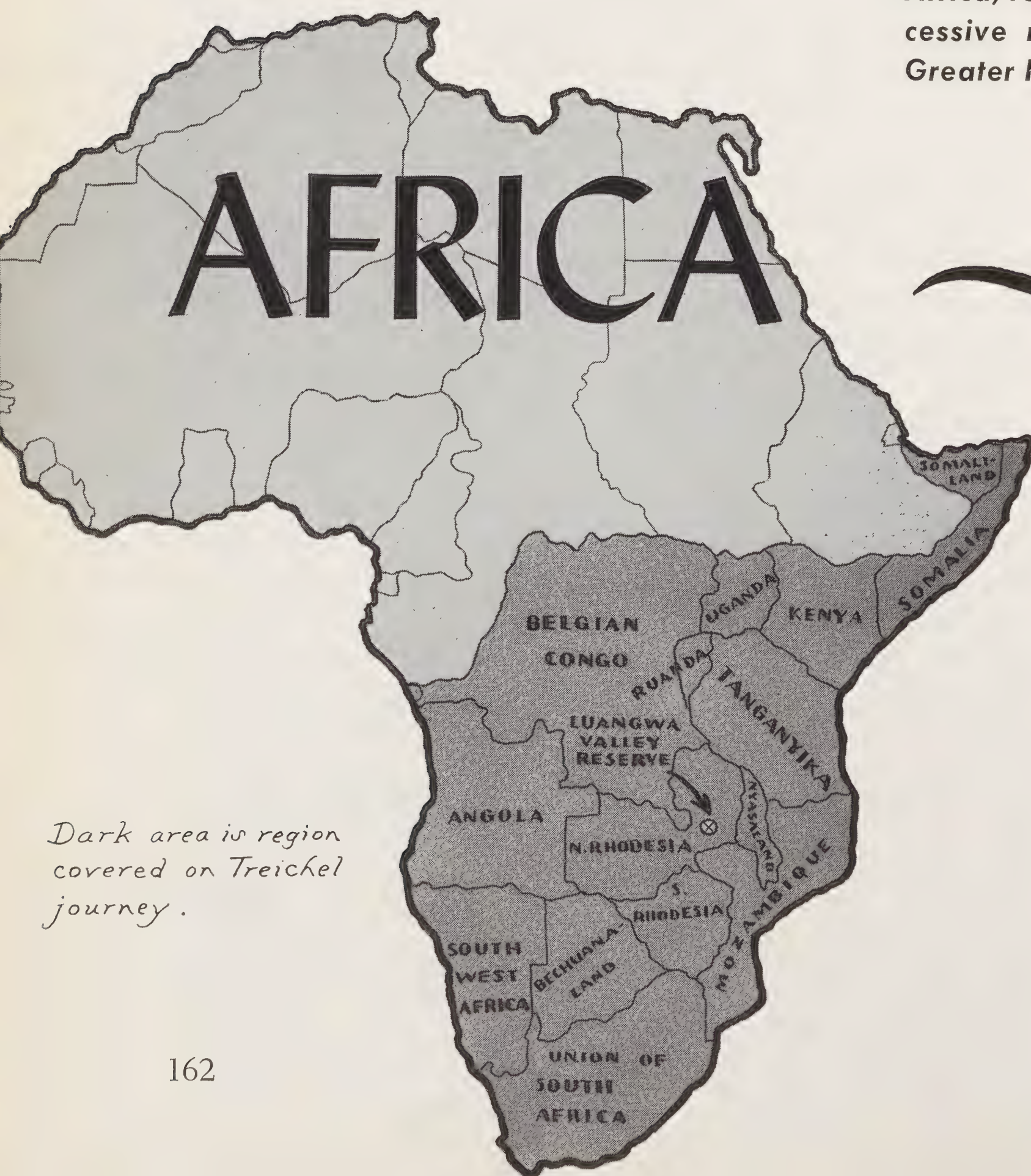
We are also at this time exploring the desirability of establishing a center for international wildlife protection to be launched under the joint auspices of the Zoological Society and the Conservation Foundation. There is definite need for concentration of action in this country, for many Americans are keenly interested in the problem and no doubt would wish to support sustained programs of work for this vital cause.

Fairfield Osborn



All photographs by JEANIE TREICHEL

Open-country scenes such as this, with zebras grazing in the Gorongosa National Park in Mozambique, are no longer commonplace in Africa, for wild fauna is being replaced by excessive numbers of domestic stock. Right — Greater Kudu bulls on the edge of Etosha Pan.



Dark area is region covered on Treichel journey.

~ AND OUR



IN ORDER to obtain first-hand information concerning wildlife protection problems in Africa, the New York Zoological Society, together with the Conservation Foundation, sought out a qualified person who would be capable of making an over-all survey of conditions in that continent. We selected George Treichel who, in addition to taking graduate work in zoology and geography at the University of California, had had field experience in the western United States, arctic Alaska and in the Caribbean, and who also had specialized in studies of African fauna.

His work in Africa extended over a year and a half. He was accompanied by his wife, who was responsible for the compilation of field notes. Mr. Treichel was stricken with poliomyelitis at the very end of his work, but we are happy to report that he is making a fine recovery so that he is now commencing work on the enormous accumulation of notes gathered in the field. As one aspect of organizing this material for eventual publication in a "Handbook of African National Parks and Wildlife Reserves," he has undertaken a series of articles for *ANIMAL KINGDOM*, of which this is the first.

WHEN THE QUICK darkness falls on the bush country of Africa, and the campfire is burning and the day's work is done, there comes a time for thinking and talking and trying to see the pattern in that day's and all the other days' experiences. Trying, in short, to comprehend Africa and foresee the future of its wildlife. Man's use and abuse of this resource was a subject that never failed.

I am thinking of one evening in particular, although there were scores like it. In the final hour

before sunset we had watched families of elephants and herds of antelopes gathering at their favorite watering pools along the Luangwa River in eastern Northern Rhodesia. As the sun went down hundreds of carmine bee-eaters circled and landed at their cavities in the river bank.

We were in the last days of a long dry season and the scene on either side of the waterway was parched and dusty — dusty as only Africa can be. In a few days the abundant rains would arrive from the Indian Ocean and this thirsty bush

WILDLIFE HERITAGE

By
GEORGE TREICHEL



country would be magically transformed into a green panorama and the river would roar mightily again. No longer dependent on the critical dry season waters, the herds would disperse over hundreds of square miles to forage and graze, and new giraffe, impala and puku antelope calves would be dropped into a fresh green environment.

On one of the escarpments far to the northwest a patch of raw Africa was burning; it was too far away for our ears to catch the crackling of the elephant grass as it flamed up, but we had heard it often enough. Fire has shaped the vegetation over immense tracts and in no other part of the world does it play such a significant role. It is believed that at present fires are more frequent and widespread than they were in earlier times and the result is often the deterioration of habitat.

We were sharing the campfire of the Warden of this particular area that night and inevitably our conversation turned to the future of the Luangwa Valley wildlife reserves. The future of this valley, like that of most outstanding faunal areas in Africa, is precarious, and for the usual three reasons:

Rapidly expanding indigenous populations requiring a little more land each year;

Rising African nationalism, which in time may eliminate the Europeans who, up to the present time, have been responsible for the wildlife reserves;

The customary degree of colonial administrative apathy in matters relating to wild animal conservation outside of the major national parks.

Now it is true that almost everyone, even the most severe critics of wild animals, is convinced that the wildlife must not be permitted to become completely eradicated over its entire range. Yet good animal areas are slowly slipping away.

The Warden, that night along the Luangwa, asked us a good many things about conservation procedure in North America and particularly about the public response when outstanding wilderness and wildlife areas are threatened by commercial or military interests. The wildlife enthusiasts of Africa are keen to learn how people in other lands are attempting to arrest the tide of desecration.

Like so many of his energetic colleagues, he was curious, too, about the reasons for our extensive safari through most of the great wildlife areas — places, incidentally, that he himself

greatly wanted to see at first hand. We explained that there was insufficient detailed knowledge of international wildlife conservation problems in our country and that the New York Zoological Society and the Conservation Foundation were trying to do something to promote American interest and participation in what might be called our international wildlife heritage. That, we explained, was why we had been sent on a study trip, to compare conservation attitudes and methodology across Africa, south of the Sahara, and to interpret information of faunal significance.

As we explained to the Warden, so should we explain in detail here what we were undertaking and how we went about it. In those thrilling months on safari we had been in the outstanding wildlife parks and also in many of the unusually

At the left of this typical road in Rhodes-Inyang National Park in Southern Rhodesia, fire has passed over the undulating highland landscape. If properly controlled, fire can improve vegetation for wildlife.

beautiful scenic areas. From the Etosha Pan veld near South West Africa's Skeleton Coast and the magnificent Gorongosa National Park near the coast of the Indian Ocean in Mozambique, we had journeyed as far north as Marsabit and the Lake Paradise Crater in Northern Kenya and Nimule National Park along the left bank of the Nile in the Sudan. Almost all of these great animal sanctuaries are "pockets" surrounded by immense native reserves and developed lands. On trips between these widely separated "islands" of wildlife, one views not animals but the emerging, developing Africa, or the serious vegetation destruction and soil erosion of the native lands. The popular image of an Africa overrun by wild animals is quite incorrect at this point in history. In fact, most native children have never seen a lion, a hippopotamus or a rhinoceros. We are no longer dealing with a mysterious continent with impenetrable hinterlands. Africa south of the Sahara is changing at an accelerating pace and with the possible exception of southeastern Angola, perhaps small parts of Ethiopia and portions of the western rainforest, no unexplored tracts of significance remain. Conversely, it must be said that although Africa is now well explored, it is very imperfectly known in the scientific view.



We attempted to obtain an accurate and detailed picture of local wildlife conditions from responsible authorities, field personnel as well as such leaders as Mervyn Cowie and Noel Simon of British East Africa and Victor van Straelen of the Belgian Congo. Besides the factual data, we also collected an important and entertaining series of opinions wherever we journeyed, for Africa is primarily a continent of opinions, not well established facts. And we attempted to avoid that American occupational hazard, dispensing unsolicited advice, which most assuredly ruffles the feathers of others! We also explained that the Society acknowledged a particular debt to Africa for, over the past half century, numerous specimens had come from that continent, bringing great pleasure and benefit to the citizens of New York. Now the Society was preparing to take an even greater interest in African faunal conservation problems.

Most of the colonial game administrators agreed that although there had been some real achievement thus far, there was no room for complacency. Wild areas in Africa and throughout the world are becoming scarcer with the passing of each month. Everything possible must be done

to inform opinion in Europe and America about the urgency of the African problem, for critical areas like Ngorongoro Crater in Tanganyika are seriously threatened. A forceful international appeal for the maintenance of wilderness and its fauna in Africa is certainly essential at this time.

What are the prospects for sound wildlife conservation in Africa? It is necessary to discuss this question in two phases: first, in the properly constituted national parks and sanctuaries, and secondly, on the remaining land of each country. The latter are vastly greater areas, usually ninety-five per cent. or more of the total land of a given country, and are devoted to native reserves and European farms and plantations as well as other commercial enterprises. First let us consider the parks and reserves of Africa.

It is important to remember that only about half of the present parks are located in what were originally the foremost faunal areas. Others were located as convenient buffer zones along international borders or in areas made uninhabitable by disease, not necessarily prime faunal areas. Many in the latter category have since become good animal areas because almost all large living things have been eliminated around them. Beyond the



peripheries of the parks most factors operate against animals, and in time all the existing parks, samples of a primeval Africa, will be maintained only if they are enclosed by suitable barriers. An example of the future is the Addo National Park in the Union of South Africa, where elephants have been fenced to separate them from adjacent citrus groves. Another example is the well-known fence that divides city and herds at Nairobi.

A major problem relates to the rather confusing terminology such as National Park, Game Reserve, Partial Game Reserve, Nature Sanctuary and Controlled Area. The animals do not receive the same degree of protection in each, and while national parks are usually controlled by boards of trustees, reserves of other types are regulated by legislatures and administrative officers. National parks are devoted exclusively to the wildlife and the visitors who come to enjoy wildlife, and are considered permanent and inviolate under normal conditions, while reserves and other categories are temporary at best, for their status can be quickly changed by the caprice of the legislatures. In addition, almost all reserves contain either tribal settlements or extensive "native rights" and in every case the interests of the native population always supersedes wildlife considera-

The Union of South Africa has done a creditable job in protecting sea birds and harvesting guano. Here the author inspects Cape Gannets nesting on Malagas Isl. near the southern tip of the continent.

tions. The grazing of enormous herds of scrub cattle and goats is the commonest native privilege. For the long-term picture we can hardly hope to keep all the reserves as they are presently constituted; therefore the most outstanding of the present ones should be elevated to permanent park status where requirements of the wild fauna and the pastoral interests of man will not conflict. But for this enlightened development we would have to obtain new agreements from the local native councils. Will they cooperate?

The answer, unfortunately, is "No" for the immediate future, for many natives view properly constituted national parks as European institutions, a strange colonial custom of setting substantial blocks of land aside for the exclusive use of wild beasts. They point out that the white immigrant efficiently eliminates animals from his own farm lands, which is true in most places, and then asks the natives to tolerate them in those reserves which they share jointly with the animals

and along the boundaries of the parks. The native leaders have not been invited to participate in working out wildlife conservation programs and every effort has been spared in selling the national parks idea to them. Fortunately this fact is now on the conscience of many park and civil administrators, and several governors have also shown concern.

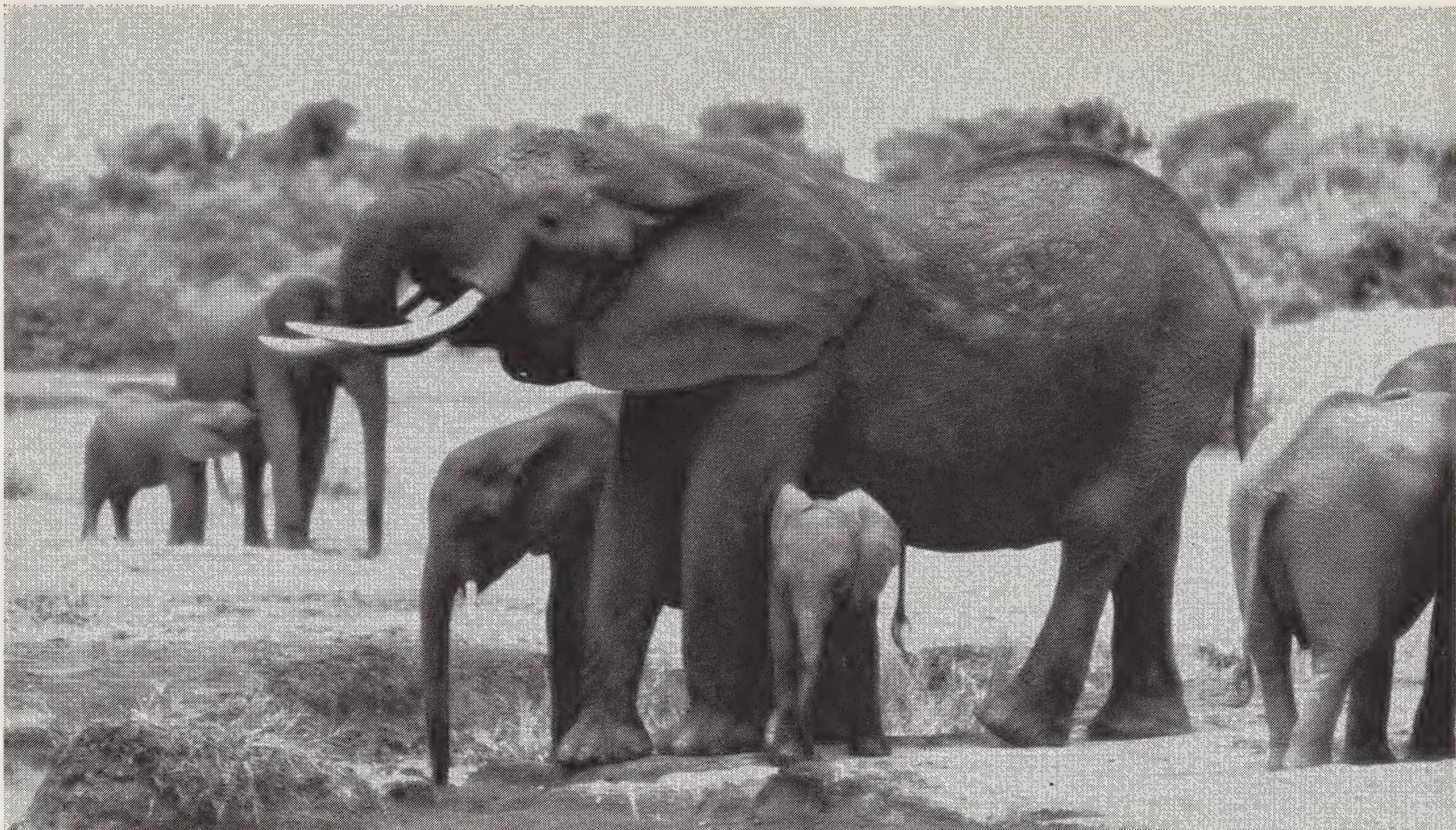
Independence seems inevitable for all but a very few political units, but to say that it is inevitable is not to say that it will work with any degree of fulfillment, particularly in matters relating to wildlife preservation or utilization. The impatient native political leaders will often make an effort to be very unlike their previous colonial masters, and their decisions regarding parks may startle and even enrage us. How can we convince them that, from a world point of view, their respective colonial governments did a creditable job? The forecast is rather gloomy unless we can interest a sufficient number of native leaders in the economic and cultural values of this resource.

The great national parks and reserves of Africa are not to be considered relatively unimportant props of the tourist industry alone, to be eliminated if more immediate political or commercial profits can be realized by other forms of land use. *They are unique cultural assets*, having not only local value but a distinct international value — which is not often comprehended by the natives. We will hope to convince them that some day, as their intellectual interests expand, they also will regard these places as priceless living museums of natural history, examples without comparison in the rest of the world. The leaders can learn that most civilized nations maintain national parks and that our total cultural heritage would be much poorer if any one of the remarkable sanctuaries were eliminated. The destruction or gradual deterioration of a major park or reserve in any part of the world would be a loss for all of us — be it Amboseli in Kenya, Yellowstone in Wyoming, the Swiss National Park in the Alps or the important Indian Rhinoceros reserves in Assam and Bengal. Eliminating them would be comparable to the destruction of the cathedrals, historic bridges or great art collections of Europe, the temples and shrines of Asia or the archeological remains of Inca and Mayan civilizations. There would also be a serious scientific loss, for

genetic stocks of animals and plants would be lost, the latter so essential in future breeding experiments for the improvement of crops.

Anyone having a familiarity with the African bush realizes that it would be overwhelmingly impossible to point out these facts to the bulk of the rural people. The tribal attitude is that all animals are simply so much uneaten meat being held, and therefore wasted, for the pleasure of the resident Europeans and their visitors from foreign lands. Some long-term residents of these countries tell us that it would be out of the question to educate natives for wildlife, that the effort and frustration would not make it worth while. This we can *never* accept, for if the conservation education effort is not worth while, then these areas and their herds will certainly disappear in the decades ahead. The progress may indeed be slower than we would like, but we desperately need the future African leaders on our side. We must persuade the persons in positions of authority, particularly the chiefs, elders, emerging political leaders and the students in secondary schools and colleges. These groups must no longer be omitted from wildlife conservation work. A start must be made with them, as has recently been done in Uganda. To keep the superlative parks which the great powers established is our urgent consideration. Our success will depend on how well we instil our feelings into men of very different cultures.

Tourism has played an enormous role in saving wildlife areas from destruction. The economic appeal is invariably the most convincing to people of all races, and a powerful argument can be made for wilderness on this point alone, particularly in countries where tourism is the third- or fourth-ranking industry. The parks and reserves serve as catalysts in promoting widespread travel and a steady exchange of currencies all across the African continent. Most visitors come to observe and photograph the greatest of wildlife pageants. Wild fauna is the important element in the primitive African scene, especially as much of the color associated with tribal life is vanishing. Most of interior Africa, without animals, is distinctly unexciting to the average sojourner. To observe and photograph wildlife at extremely close range one must invariably *enter* the reserves, except perhaps for a few restricted parts of East Africa. In



other areas one could easily travel tens of thousands of miles over African roads outside of the reserves today and see neither lion, elephant nor any wild herds. A vigorously expanding tourist industry has for selfish reasons pressed for good park conservation in numerous areas, and this will continue as increasing numbers of tourists are brought into Africa by jet aircraft. Increased tourist revenues will depend to a large extent on animals, and thus the park concept will be made a bit more convincing. Several governments are treating their park organizations properly only because of the economic factors involved. This should hold good in the future as well, but at no time should we permit the parks to become mere settings for the amusement of *excessive* numbers of tourists, as has happened in parts of the Kruger. This problem is too well known in some of the American parks.

Besides the present protected areas there is a critical need in each country for additional samples of each major habitat type to be set aside for scientific and touristic purposes. Systematic surveys of all remaining wild lands should be made and new reserves created before it is too late. Most countries view wild land as something to be gotten rid of and uninhabited wild tracts actually worry many planners. Instead, the remaining wild areas should be viewed as a bank of

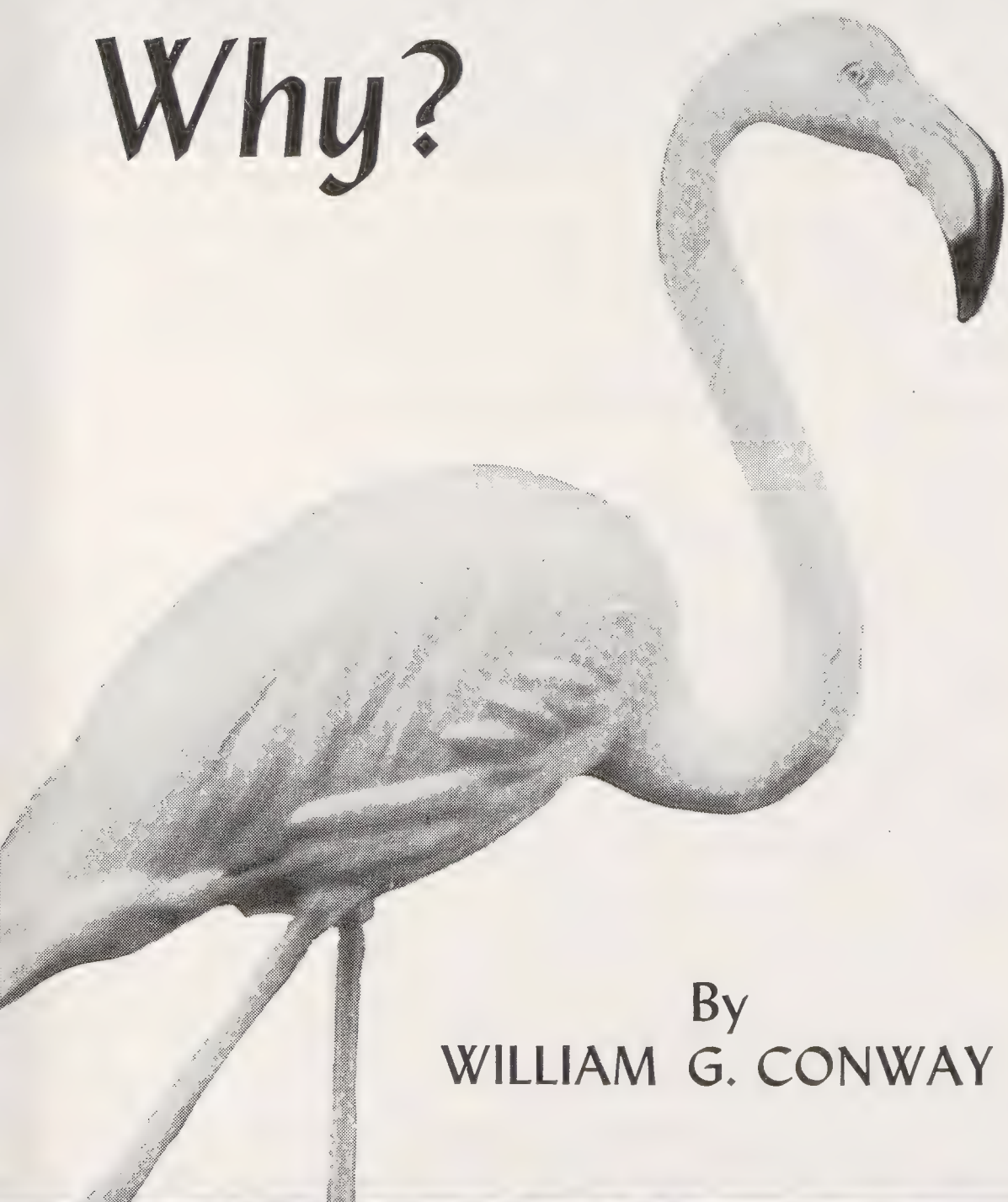
Large herds of Elephants can readily be seen in national parks in Uganda and the Congo, although imposing tusks are rare. Elephants are "holding their own" in most countries today.

resources for possible later use, not as possessions to be exploited quickly and by any means. The ecology of the whole living plant and animal community should form the basis of the conservation movement, with representative samples of vegetation types placed in trust.

Extensive wetlands and natural coastlines should receive special attention. The magnificent Cape coast should be secured for all time before developments modify it. In Africa, unlike many parts of Europe and America, there is still time and hardly an excuse for default. A minimum requirement would be to zone and delimit the new areas on maps. It is quite true that unprotected and unpatrolled reserves are very unsatisfactory solutions, but initial lines on the map have often been the vital first step in the transition to a properly administered sanctuary or park.

This discussion will be continued in the next issue of ANIMAL KINGDOM. Wildlife living outside of the national parks and reserves, the role of the tsetse fly, sport shooting and game ranching will be considered.

It's Carrot Oil That Makes Our Flamingos Red--But Why?



By
WILLIAM G. CONWAY

MANY RED BIRDS fade to dull pink, yellow or even white in captivity, and perhaps none fade more easily than the largest of red birds, the American Flamingo. In one year a deep vermilion, wild-caught flamingo often becomes sadly pale, a washed-out caricature of its former self. We know that diet is the key to this problem and that the molluscs and crustaceans which form a large part of the American Flamingo's diet in the wild state contain some substance or substances which the flamingo utilizes to color its feathers and the red portions of its skin.

The basic facts behind the fading problem are simple. First, birds replace practically every feather on their bodies at least once a year. This means that a new, bright-red bird will shed all its feathers within the coming year and reproduce them by the agency of whatever food we provide at the Zoo. Second, bird feathers are essentially dead structures, once they have reached their normal size, and they change only very slowly through deterioration or wear, so that special measures taken to improve feather color after a flamingo has molted to a pale pink will have no effect until the next molt, perhaps a year away. Since a flamingo's feather color is the direct effect of its diet, this means that we cannot be satisfied with feeding flamingos a ration which just meets the bird's basic nutritional needs for fats, proteins, carbohydrates, vitamins and minerals; we must also supply special ingredients that will produce a normal feather color.

Although the European Flamingo is the largest of the six species (standing nearly five feet high), it is a pink-and-white bird; the American Flamingo is the only really strong red one.



The flamingo fading problem is most severe with the American Flamingo, for not all flamingos are red all over. Six species of flamingo are recognized and although they vary greatly in size they all have the typical flamingo appearance and would never be mistaken for anything else. The American is the only really red one; in the wild state, all the others are just more or less pink or white birds with red wings. The smallest forms are the Lesser Flamingo, which ranges in Africa, Madagascar and India, and the James's Flamingo, which dwells in the high lakes of the Andes. Neither of these birds stands much over two feet high. Larger, measuring over three feet tall, are two more South American birds, the Chilean and Andean Flamingos. The tallest species, the European or Greater Flamingo, which stands nearly five feet high, ranges from southern Europe to Africa and India. Finally, the American Flamingo, only slightly smaller, is found from the Bahamas through Cuba and Yucatan to northeastern South America, and even has a small population in the Pacific on the Galapagos Islands.

The flamingo's feeding apparatus, an important consideration in the food-linked fading problem, is one of its most distinctive features. Tongue and beak are lined with sturdy filaments

The two birds in the center are Lesser Flamingos of Africa, Madagascar and India, first of their kind in America. They came to us from the Chester Zoo in England. American Flamingos are at left and right.

in a comb-like arrangement which, with the support of the tongue's powerful pumping action, contrive to give the bird a superb straining apparatus. With this device the flamingo is able to tap an incredibly rich source of food probably available to no other large higher vertebrate. It can eat the minute animal and vegetable life contained in the mud of lake and lagoon bottom.

A satisfactory flamingo diet in the zoo must meet several criteria. It should be palatable and of such a consistency that the birds will eat it. This means a food that is soupy-mud-like in texture, a mixture on which the flamingo may employ its super strainer. Next, it must meet the bird's nutritional requirements and, third, it must be practical to prepare, easy to feed and reasonably economical. Besides all this, the food must provide substances to keep the birds in good color. The first two or even three of these requirements have been well met in zoos for years and insofar as health is concerned, flamingos are now nesting in captivity and we know of at least one indi-

vidual which has lived more than forty years on a captive diet. The color requirement has been more difficult to solve, but now most zoos are meeting it with greater success. Like most zoo-keeping difficulties, it is well to review the situation in the wild state to find a base from which to attack the problem.

Biochemists who study animal "biochromes," such as Dr. Denis L. Fox of the Scripps Institute of Oceanography, tell us that the pigment found in the skin and feathers of the wild American Flamingo is mostly a carotenoid called astaxanthin, and that none of the higher vertebrates seem to be able to manufacture this substance themselves. Many lower creatures, however, from goldfish to potato beetles, have no trouble producing it from a variety of animal and vegetable carotenoids or carotenes in their diets. Consequently, flamingos must obtain their red pigment from the lower creatures they feed upon, and food analysis has shown, as we would expect, that the American Flamingo's natural foods are extremely rich in astaxanthin.

With the additional knowledge that such foods as salmon, lobster carapace and shrimp are all rich in astaxanthin, it would seem easy to put together a diet that would produce red flamingos. Actually, we have tried these various additives with some success, but unfortunately they all have prohibitive drawbacks. Think back to your last shrimp cocktail and imagine what it would cost to provide more than twenty flamingos with this fare every day. Lobster and salmon are less expensive but require considerable labor to prepare for the flamingo's comb-mouthed bite. Aside from these considerations, there is the important point that fresh seafood such as shrimp or salmon is apt to spoil quickly while standing in a flamingo's feeding pan on a warm August day. Even if all these handicaps could have been overcome, one big one remained: the seafood supplements did not really turn our American Flamingos red — not the shade of red we wanted them to attain. We decided to look further.

There was no doubt about the palatability of the new diet devised for the Flamingos. All of them took to it readily. Furthermore, it is a great deal easier to prepare than the old diet.

Dr. Fox had demonstrated that the principal red pigment of the wild American Flamingos with which he worked was derived from certain small animals, such as the horn shell, rather than from vegetable items, such as algae, which do not carry astaxanthin. Nevertheless we knew that some flamingos, such as the dark pink Lesser Flamingo and perhaps the Andean and James's Flamingos, include considerable algae in their diets. From food analysis studies, it certainly appeared as though some vegetable carotenes would have to play a part in coloring some of the species in habitats where good animal carotenoid sources were not available. Besides, aviculturists have for years successfully used vegetable carotenoids in the form of capsanthin, by feeding their flamingos on ground sweet red peppers. Indeed, we had always attributed some of the birds' color to the high percentage of carrots which their diet contained. Then we learned that the Philadelphia Zoo was keeping its flamingos in excellent color



by feeding them great quantities of carrot juice. We attempted to procure some fresh carrot juice for experimentation but found that it was difficult to obtain in New York, expensive, and did not keep well under our conditions. We considered increasing the quantity of fresh ground carrot in our ration, but soon saw that it would overbalance the diet so badly that we could not continue to meet the birds' nutritional needs. Then, too, we were beginning to realize that a simple additive was not the entire answer to the problem.

Breeders of red-factor canaries know that certain food items seem to have an adverse effect upon the red coloring of their birds, even though they hold their color foods constant. Thus a breeder may find that the addition of cod liver oil to a diet which previously brought his birds to a deep red color may make it impossible to produce canaries with hues stronger than a pale orange. The poultry industry is vitally concerned with the color of the skin and flesh of chickens and the yolk color of the eggs it markets. Research has enabled the poultry raiser to determine, at will,

the deepness of the yellow of the yolk in the eggs he sells, and he can cater to the New York taste for a rather light yolk or the mid-West taste for a rather dark yolk. Some common poultry feedstuffs, such as soybean oil meal, meat scrap, fish meal and fish oils, contain a factor or factors which inhibit the deposition of yellow pigments in the beaks and legs of growing chickens. On the other hand, chickens fed the dye Sudan III or lobster shell, carrying astaxanthin, will lay eggs with bright red yolks! Bearing these facts and others like them in mind, we decided to look for ingredients for a new flamingo menu. We settled upon a commercially available poultry ration to form the basis of a new food which would be low in feedstuffs that might detract from the deposition of pigment in bird feathers. Then we supplemented this "Super Laying Mash" to meet what we considered to be the special nutritional and palatability requirements of flamingos. Finally, we resumed the search for a source of concentrated carotenoids.

Casting about for such a product, we wrote to Dr. A. F. O. Germann, president of Nutritional Research Associates, Inc., and he submitted a list of substances which he felt might make flamingos red, among them one consisting essentially of carrot oil and certain other items in a dry mix. "Caradee," as it is called, is normally used as a source of Vitamins A, E and D in the poultry feed industry. It would enable us to eliminate cod liver oil, which might adversely affect color deposition — and most importantly, it contained 250,000 units of carotene per pound.

Armed with our new flamingo diet, of which 10% was "Caradee," we decided to begin an experiment. In the middle of January, the flamingos' old ration was cancelled and the new food substituted. The following morning Aquatic Bird House Keeper Bardsley happily reported the new course had passed the palatability test — the birds ate it readily. We knew this ration was economically feasible and considerably easier to prepare than the old food had been. From its composition



This attractive and colorful signboard telling about the various species of Flamingos and our efforts to improve their color was designed by Curator of Birds Conway for the exhibit.



To a Curator of Birds, this is a most gratifying sight: bright red feathers (showing here as a darker gray patch on the wing) have been produced by a new diet containing carrot oil.

we had every reason to expect it to meet the flamingos' nutritional requirements and now had only to wait and see if the birds would turn red. However, this promised to be a long wait, for flamingos have a major molt only once a year and that takes place in late summer and early fall. We were too impatient to wait, so on February 19 Keeper Robert Edington helped me catch two flamingos and pull a large, square patch of feathers from their right wings. As new feathers came in, a few weeks hence, they ought to show the effect of the new diet.

From this time on, the flamingos got little peace. Keepers and curators formed a steady procession through the birds' winter quarters, the optimists looking for red patches to appear, the pessimists for white or merely pink new growth.

On March 23 Head Keeper Bell and I caught

the two test birds. Each rewarded us delightfully by showing a wonderfully deep rose-red patch of feathers on its pale pink wing!

The flamingos have now entered their normal complete molt and are gradually becoming a lovely deep rose-red, and we believe they will be especially bright next spring, for we are continuing the experimental feeding formula. Nutritional Research Associates, through Dr. Germann, has been interested enough to donate all the "Caradee" we have used to date — several hundred pounds.

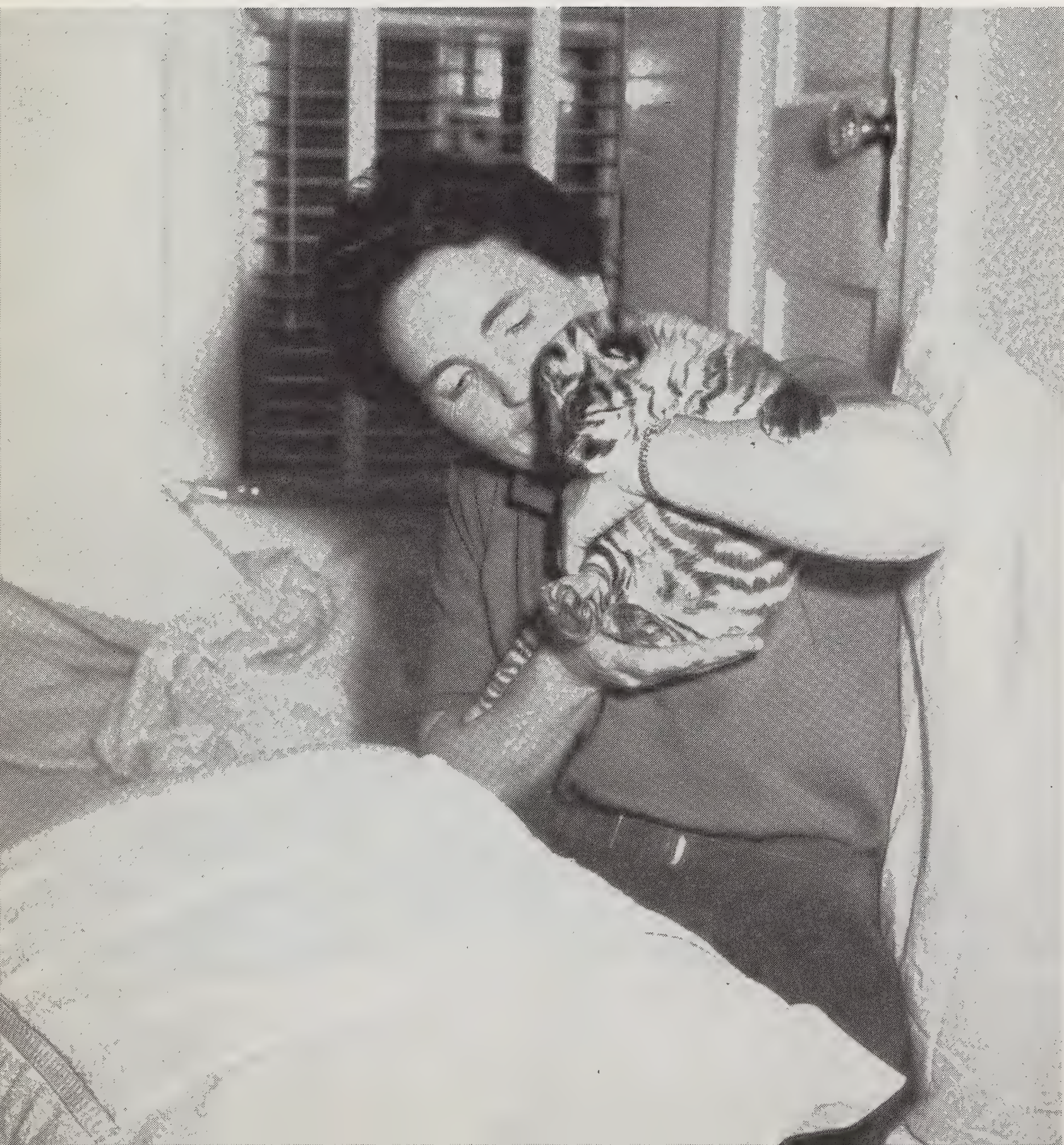
While some of the flamingo color riddle is solved, from the zoo standpoint, this experiment has raised some new questions. The new diet contains no source of the supposedly essential astaxanthin, or, for that matter, any other major source of animal carotenoids. Obviously, our birds must be utilizing some other pigment and it must be a vegetable pigment from carrots. Who would have suspected such flexibility in the flamingo's color biochemistry? We are getting our red flamingos, all right. But *why*?

Newcomers in the Zoo

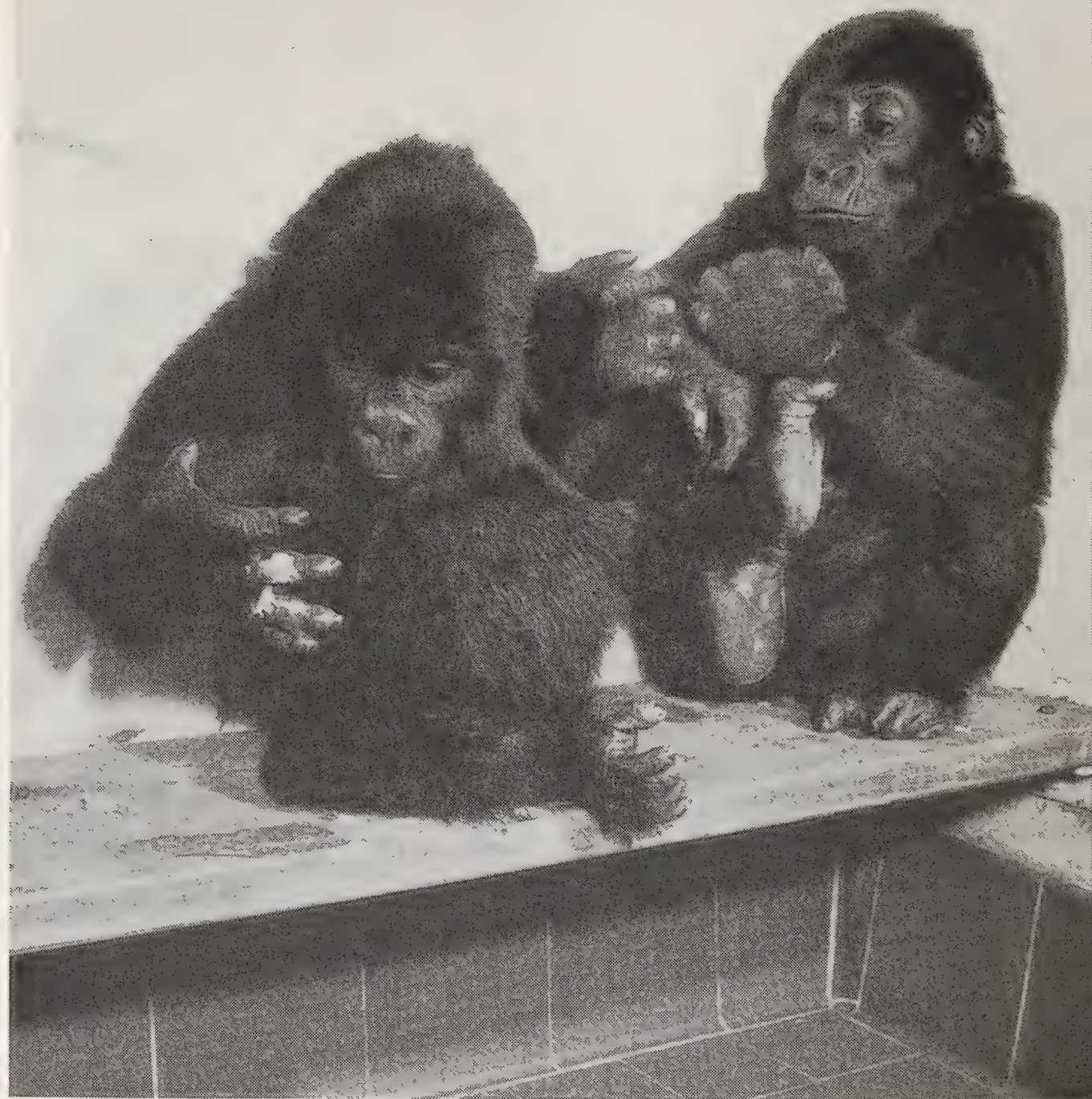
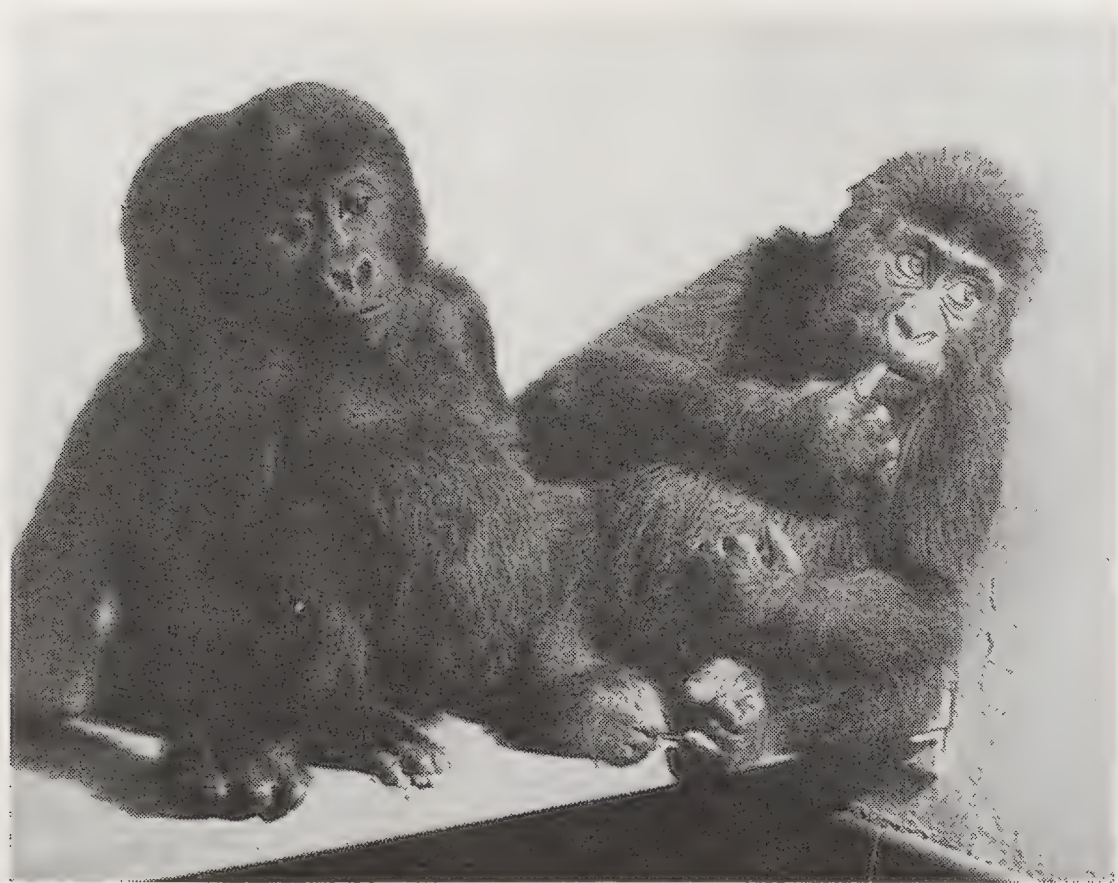
Photographs by
SAM DUNTON



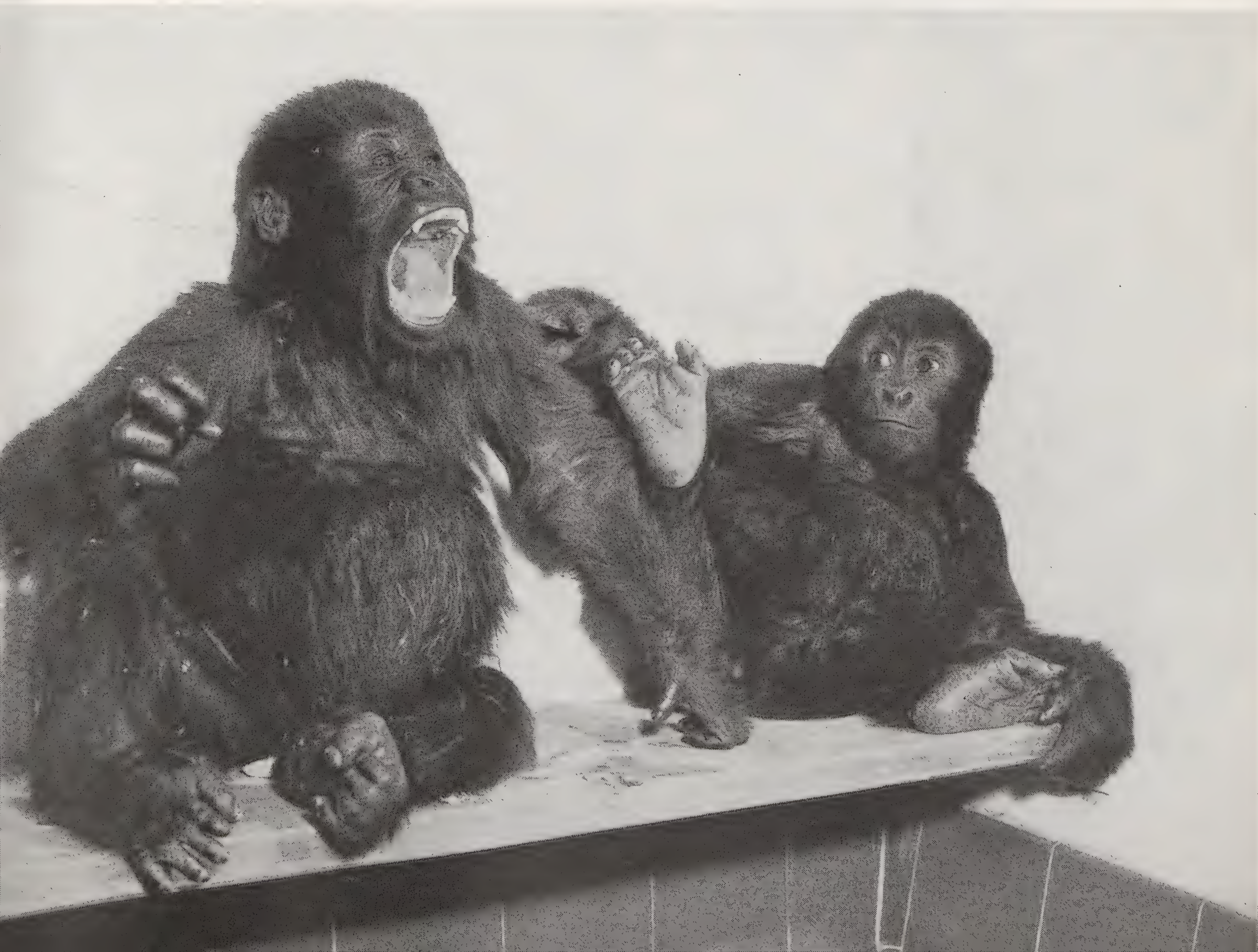
At daybreak one morning in the early 1870s a curious, spotted little animal was found wandering around the courtyard of a building in Peru. It was the first **PACARANA** known to science and no more were seen for many years. We have had Pacaranas off and on since 1915 — the last ones in 1933 — but now we have received from Colombia a tame and friendly pair, about a third grown.



Is history repeating itself here? We hope so, for the **TIGER CUB** with Mrs. Helen Martini is intended to be an eventual replacement for Dacca, our now elderly Tiger who has been the mother of 31 cubs. The youngster was one of a pair born on November 8 and named Dacca II and Rajpur II, after their mother and father. Rajpur II has been left with his mother in the Lion House, but little Dacca II was turned over to Mrs. Martini for hand rearing in the expectation that she will grow up to be as gentle and friendly as the original Dacca. Some day we will get a wild-caught young mate for Dacca II.



These engaging, vocal and expressive babies are **MOUNTAIN GORILLAS**, the only pair in the United States. Until they arrived from the Belgian Congo on November 12, our young female, Sumaili, was the *only* Mountain Gorilla in this country, and we especially wanted a pair—in the hope, naturally, that some day they might present us with offspring. These newcomers are estimated to be a little more than a year old; the male weighs 22.2 pounds and the female 29 pounds. They were captured somewhere in the volcanic region of the eastern Belgian Congo by Charles Cordier (who brought Sumaili to us in 1949) and they appear to be in excellent health. For the time being they are being kept in the Animal Hospital for physical checkups. We have not given them names yet.



SKUNKS—

Variation on a Natural Theme

By RICHARD G. VAN GELDER

*Acting Chairman and Assistant Curator,
Department of Mammals, American Museum
of Natural History*

This is the second of two articles on the Skunks of the New World. The first article appeared in the September-October issue of ANIMAL KINGDOM. — Ed.

AMONG THE NATIVES in some parts of Latin America, the flesh of the Hognosed Skunk is reputed to have curative powers. In 1953, in central Mexico, I was skinning a Hognosed Skunk in the patio of a friend's home one day when one of the native servants, who had been watching me, asked what I was going to do with the meat. I explained that I was going to use it for bait to catch more skunks, and she mentioned that the meat was useful in curing acne. I noted that the girl had a rather bad case of acne, and offered her some of the flesh, but she refused. I didn't really blame her, for the animal had been shot by some local hunters and it had been in the sun for a day or so before it was delivered to me and was a bit high. So I never did find out how you apply the meat or what effect the "patient" thinks he is getting.

On that same trip, however, I did have the opportunity to eat skunk, and found that roast young Spotted Skunk is as tasty a dish as one could desire. True, there was scarcely enough

meat for two of us, but there was nothing wrong with the flavor. We noted no particular attribute that might give rise to its use as a medicine, but we were rather unnerved the next morning to find that the cat had refused to eat the cooked skunk scraps we had left for it.

"Hognosed," incidentally, is a most appropriate appellation for the large, squat, badgerlike skunk that is found from the Straits of Magellan to the southwestern United States. The nose of this skunk, if not precisely like that of a hog, does resemble it somewhat in being rather long, naked and blunt, and is used in piglike fashion to "root" in the ground. When in search of the grubs and insects that make up much of its diet, the Hognosed Skunk may tear up large patches of ground with its powerful legs and long claws. In Arizona and New Mexico, where the Striped, Spotted and Hooded Skunks also are found, the Hognosed Skunk is often called the "Rooter Skunk." In common with its smaller relatives in the subfamily Mephitinae, the Hognosed Skunk pos-





The Hognosed Skunk does not have a nose quite like a hog's, but it uses its nose in the way a hog does — for rooting in the ground to find grubs and insects, major parts of its diet.

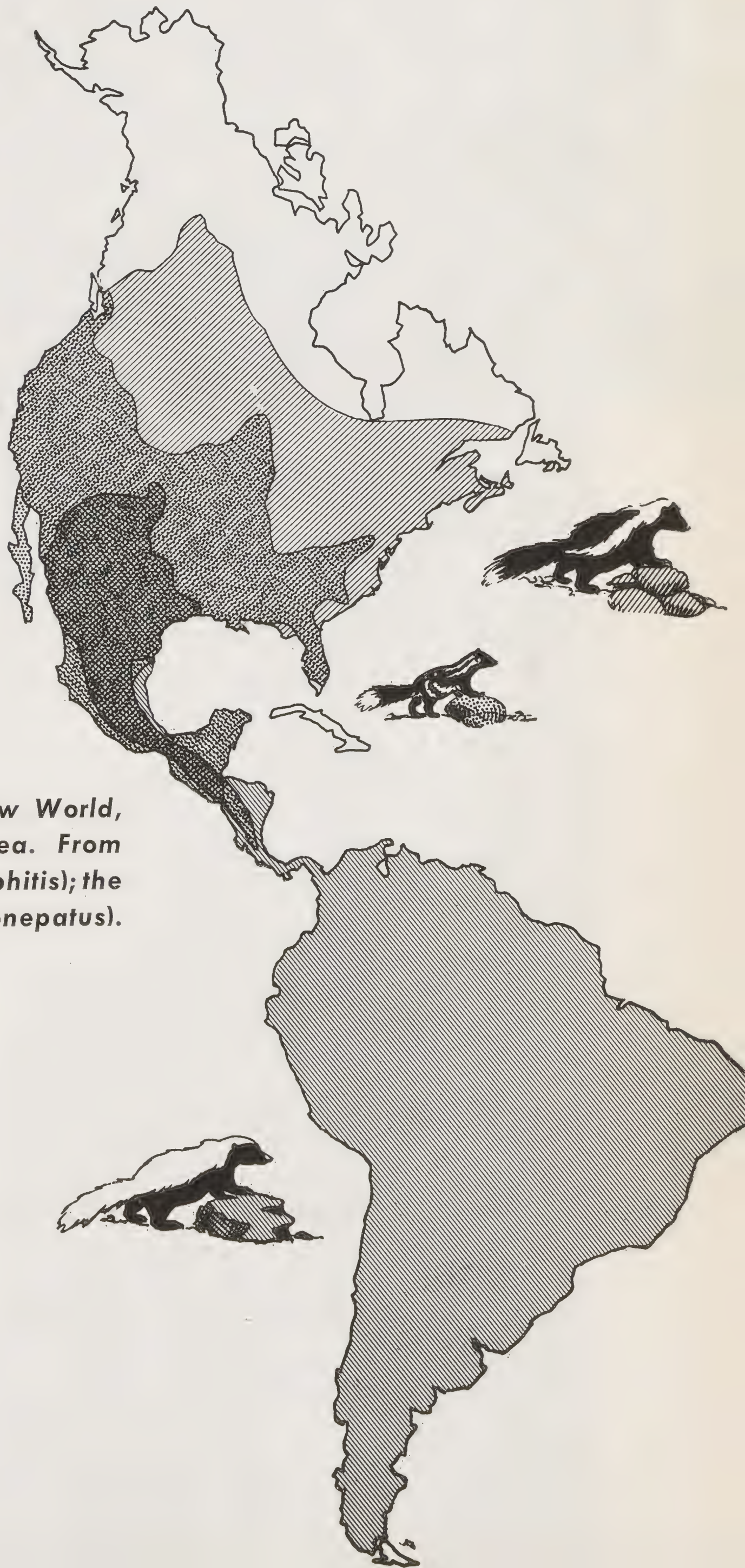
Photo by Texas Game & Fish Commission

Skunks range over most of the New World, and all three overlap in darkest area. From top to bottom: the Striped Skunk (*Mephitis*); the Spotted (*Spilogale*); the Hognosed (*Conepatus*).

sesses the distinctive musk and the black and white color, but because of its different shape, arrangement of stripes, and cranial features, it is classified as a distinct genus, *Conepatus*. At the present time there are recognized some seven species and more than 30 subspecies of Hognosed Skunks, which vary in size and color pattern as much or more than any of the other skunks.

The Hognosed Skunks that are found in the southwestern United States, from Colorado southward into Mexico, are solid white above and black below, and have a wholly white tail. This

general color pattern holds true in places where the Hognosed Skunk and the Striped Skunk (*Mephitis mephitis*) have overlapping ranges. It is quite common for two species that are closely related to be more distinct from one another in places where they come in contact than they are elsewhere. Once out of Striped Skunk range, the Hognosed Skunk seems to take on the appearance of the other, for in central Mexico and in many places in South America there are Hognosed





There is more than a hint here that this Spotted Skunk is not taking very kindly to the presence of the photographer. A tail raised on high is an unmistakable warning to keep well away.

Leonard Lee Rue from National Audubon Society

Most northern of the skunks is the Striped, which is found in this area. It is a bold animal, hence often hit by automobiles. There are far fewer fatalities among cautious Spotted Skunks.

Photo V. B. Scheffer, Fish & Wildlife Service

Skunks which might easily be mistaken for Striped Skunks — except that they never have the thin white stripe down the face.

An interesting attribute of the Hognosed Skunk, in parts of South America, at least, is that it possesses high resistance to the venom of pit vipers. Although this has not been tested on any of the North American species, it seems so well established in the skunks of the Andes that even those species that live high up in the Cordillera and are well out of the range of any poisonous snake have a strong resistance to the venom. There is some evidence, also, that the Spotted Skunks may also possess some degree of resistance to the bites of rattlesnakes. A recent study has shown that skunk musk produces an “alarm reaction” in rattlesnakes. This is the same reaction that rattlers go through when in the presence of king snakes, which prey on them, and may indicate that skunks are greater predators of rattlesnakes than previously thought. Perhaps in the not too distant future inhabitants of rattlesnake country may be using real or synthetic “skunk odor” to ward off rattlers.

The early explorers of the Western Hemisphere were also greatly repelled by the odor of the skunks that they encountered. For several

hundred years the odor was thought to be the urine, or urine and feces mixed, of the animal, and the method of dispersal was described in various imaginative ways, including the animal tipping its tail in the secretion and sprinkling it about. It was not until 1844 that the first accurate description of the anatomy of the anal armature of the skunk was described: “two glandular sacs of an oval shape, about three-quarters of an inch in diameter, covered with a muscular envelope, and opening into the rectum, quite near to the anus, by two papillae.” These glands, in fact, are possessed by all members of the weasel family, but it is only among the skunks that they reach such a high degree of development.

The secretion is known chemically as a mercaptan, one of a group of compounds renowned for being repulsive and persistent. The odor may last for many years, and in the presence of moisture seems to reappear in skins that previously seemed odorless. Until recently when new processes of removing the odor came into use, a rainy day could cause considerable embarrassment to a woman in a skunk-dyed-something-else coat.

Naturally, so powerful an effluvium has been tried as a cure for any number of ills. It was reputed to be effective in aiding victims of asthma,

but at least one patient, who felt that his ailment was helped by skunk musk, gave up the treatment as being worse than the disease. A clergyman is reported to have kept a vial with the musk sacs of a skunk in it, and when beset with an attack of asthma would uncork the vial, sniff, and get instant relief. But he made the mistake one day of treating himself in the midst of his sermon, and his congregation receded.

In collecting museum specimens of skunks, as I have, one is often exposed to the threat of being

socially ostracized for long periods of time. I have been fortunate in this regard, as a result of a combination of luck and the ability to remove the odor of a skunk from my clothes and person, but there are inevitably lingering feelings of insecurity, and a sense of doubt if other persons seem to stare a bit too long. After long exposure to musk of a skunk, the nerve endings which transmit odor seem to become tired, and you yourself are no longer aware of the scent.

In northern Arizona one November, I had just



broken camp and was driving through the brush on my way back to the highway, to drive to Flagstaff where I intended to study some specimens at the Museum of Northern Arizona that afternoon. A big Striped Skunk darted out in front of the car. I grabbed my pistol off the seat, jumped from the car and gave chase. The pistol, unfortunately, was loaded with a .22 dust shot, which has a very short range and ordinarily was used only for mice or bats.

It was a fair fight and must have been a rare scene to whatever creatures were observing. The skunk and I had about equal speed in that rough chaparral, and our mutual firearms had approximately the same range — and our ammunition was limited. I ran along behind and just about out of range of the skunk (and also of my pistol). Periodically the skunk would stop and we would exchange shots, and after ten minutes of this it was clear that neither of us was having much effect on the other, except for exhaustion. Finally I was able to get off a lucky shot that damaged his artillery and the fight was soon over. I cut the scent sacs out, washed my hands in my “skunk remover,” threw the animal in the trunk of my car for later skinning, and proceeded on to Flagstaff and the Museum.

It was about three hours later when I arrived, and the Museum was just about to close. I dashed up the walk and asked the receptionist if I could see the Curator about examining their collection of skunks. The receptionist disappeared, and I had a chance to catch my breath. And that breath was loaded with skunk odor. I was quite embarrassed to have come dashing into the Museum asking to look at skunks and smelling like one, and when the receptionist returned, I started to apologize by mumbling “The odor of skunk. . . .” Before I could finish she cut in to say, “Yes, isn’t it terrible? There’s a family of them living under the Museum and one of them cut loose last night.” I was saved, but that is what I mean about feeling insecure when you work with skunks.

Other than that I have somehow managed to avoid getting “stunk up” by skunks, although I have had some other close calls, including accidentally stepping on one. The other half of my success has been in removing skunk odor. A cup of household ammonia in a bucket of water al-

most instantly removes the odor. I have skinned skunks in some of the best motels and hotels around the country, with never a word of protest from the management because they weren’t aware of it. After I had killed the animal, I would cut out the scent sacs and discard them, and then swish the animal around in my ammonia-water solution for a few seconds. No more odor.

Whenever a discussion about skunks arises — often among my circle of friends — the question comes up as to whether it is better to pick a skunk up by the tail, or hold the tail down, as a means of halting the expulsion of musk. I don’t know the answer. I do know that skunks do not seem to like to get their tails in their own musk — but I have seen them do it. I also remember trapping a Spotted Skunk and having the trap tied to a 15-foot pole so I could pick the animal up and have its feet off the ground to see if it could spray and when I did so, the agile little creature just twisted around, got all four feet up on the dangling swaying trap, and fired away. On the other hand, a Spotted Skunk that I trapped in Mexico fell over a small ledge and dangled by one foot, and did not fire at all although I came and stood within six inches of it. The final solution to this problem will require a properly established test, and a great deal of fortitude on the part of the investigator.

When skunks get in trouble and have to be removed from tin cans into which they thrust their heads, or from live-traps through which they can spray, and the like, one can usually approach them quite closely by moving slowly and standing still whenever the skunk appears ready to fire. With enough patience, the animal can be approached closely enough to be covered with a cloth or box and can then be removed slowly and steadily to a spot where it can be released with a minimum of local disturbance.

Another question I am often asked concerns skunks as pets — “descended skunks,” that is. Most of the time I try to discourage the keeping of skunks as pets because I do not feel that they are particularly good as house animals. What most people who make this inquiry want is a dog that looks like a skunk. They want an animal that will respond to their beck and call, will be affectionate and will attract some attention. Most skunks do not take well to training, although I

have seen a few that do. Most of them are not in the least affectionate, although some are. All of them attract attention, though.

Skunks in the household tend to go their own way, wandering about as they see fit and climbing over the owner if he happens to be in the way. They can be housebroken to a limited extent, and they are easy to care for. I have had my share of them; I like them; if another was given to me, I would probably accept it. But I still don't recommend them as pets for the average person.

The operation to remove the scent sacs from a skunk is a simple one and has little effect on a young animal. Removal of the sacs from an adult, however, may kill it. I have always had the greatest admiration for two old maiden ladies who raised a skunk from a very early age, but never got around to "descenting" it. Although it was perfectly tame and friendly and had never even indicated that it might use its powers, the women feared that some accident in the house — such as a dropped dish — might have a disastrous result. But when their veterinarian explained that there was an element of risk in "descenting" their skunk, they chose to keep it as it was, and live very, very carefully. And so far as I know, they have been very, very lucky thus far.

Evolution often takes conservative courses. Time-tested characteristics of animals are not readily discarded, and it is therefore somewhat surprising to find in the skunks such complete dependence upon a single defense. The Striped Skunks are the best example of this reliance on odor. From a weasel-like, sly, sulking, swift ancestor they have evolved into an animal that cannot run quickly, that seems to show no fear of any creature and that wanders about confident in its reputation. True, a skunk can give a nasty nip, if necessary, but such a bite is no defense against a larger predator. The Striped Skunks have forsaken all the normal defenses of a small carnivore and have staked their existence upon their reputation. The more primitive Spotted Skunks have not progressed so far along the evolutionary road as their larger cousins, and they still are wary of open spaces and moving objects, can run rapidly and can even climb trees. In country where both Spotted and Striped Skunks are common, rarely is one of the former seen dead on a highway, although the roads may be littered

with the carcasses of Striped Skunks. The basic behavioral attitude of the two genera differs — the Striped Skunks seeming to say "Here I am, you had better stop," to an approaching car, and the Spotted relatives not venturing forth until the road is clear. This makes for a major difference in mortality rate. The Hognosed Skunks, like their striped relatives, are also overly confident, but up to now they inhabit country in which there are fewer roads and less traffic, and so they suffer only slight mortality therefrom.

At the present time man seems to be the greatest enemy of the skunk. In densely populated areas, automobiles, dogs, trapping and shooting are the major controls over the size of skunk populations. The production of four or five young a year, however, has permitted skunks to persist in metropolitan areas despite man's mostly unintentional control. What happens in wild regions is not known. It would seem that skunks would soon overrun an area, assuming that there are four young a year and that the life-span is some six to eight years. Nevertheless, although skunks are sometimes quite numerous, they never reach the numbers that might be expected. Some young skunks are killed by snakes, and perhaps a few adults also die this way. Great Horned Owls are also known to be predators of skunks, for these birds have been found reeking of skunk odor and skunk skulls have been found in their pellets. But most likely a very high proportion of skunk mortality is from predatory mammals that are in the process of learning to avoid skunks. In other words, the knowledge to avoid a skunk is not an inherited trait, it must be learned. And when a predator has approached a skunk closely enough to experience a shot of musk, it may well be in the last few steps of a charge that results in the death or mortal injury of the skunk. More than likely that individual predator will never again attack a skunk, but it has cost the life of one skunk to teach the lesson.

The skunks, Spotted, Striped and Hognosed, represent variation on a natural theme. United by common ancestry, alike in color but different in pattern, possessed of an identical defense method, these members of the weasel family show some of the infinite variations that have resulted from the various factors that influence the processes of evolution.

A Mouthful of Babies

By JAMES W. ATZ



OF ALL THE MANY STRANGE WAYS by which fishes protect their offspring, certainly the most unusual is oral incubation in which the parent carries its young about in its mouth. Some fishes build nests to house their eggs and fry, and others carry their offspring with them — kangaroo-fashion in pouches, or hanging in clusters from a hook on the forehead, or glued to the skin of the belly — but the acme of parental care among fishes is practiced by the

species that use their mouths as living incubators. Among the favorite foods of fishes are fish eggs and baby fish — not only those belonging to others, but their own as well. When this fact is coupled with the observation that some species incubate eggs and young in their mouths for as long as two months, all the while becoming more and more emaciated from lack of food, the truly marvelous nature of this behavior is apparent.

For the past year the Aquarium has had on

exhibition some of these marathon mouthbreeders, and last summer they bred in one of our tanks. Although the fish were unsuccessful — that is, no young were produced — we have high hopes that the performance will be repeated next summer and that we shall be fortunate enough to witness the crucial part of it, and thus be able to solve a mystery that has puzzled ichthyologists for years.

The fish is *Galeichthys felis*, the Sea Catfish. This is one of the commonest of shallow-water species of our south Atlantic and Gulf coasts. It has been caught as far north as Cape Cod, but is not regularly taken beyond North Carolina and is a rare visitor to the waters around New York. The southern limit of its range is Panama. Sea Catfish inhabit bays, sounds, estuaries and other shallow waters, sometimes in enormous

Typically, the Sea Catfish in the Aquarium's tanks keep close together as they swim. The fish in the foreground, with large ventral fins, is a female. Just above her is a male with smaller ventral fins.

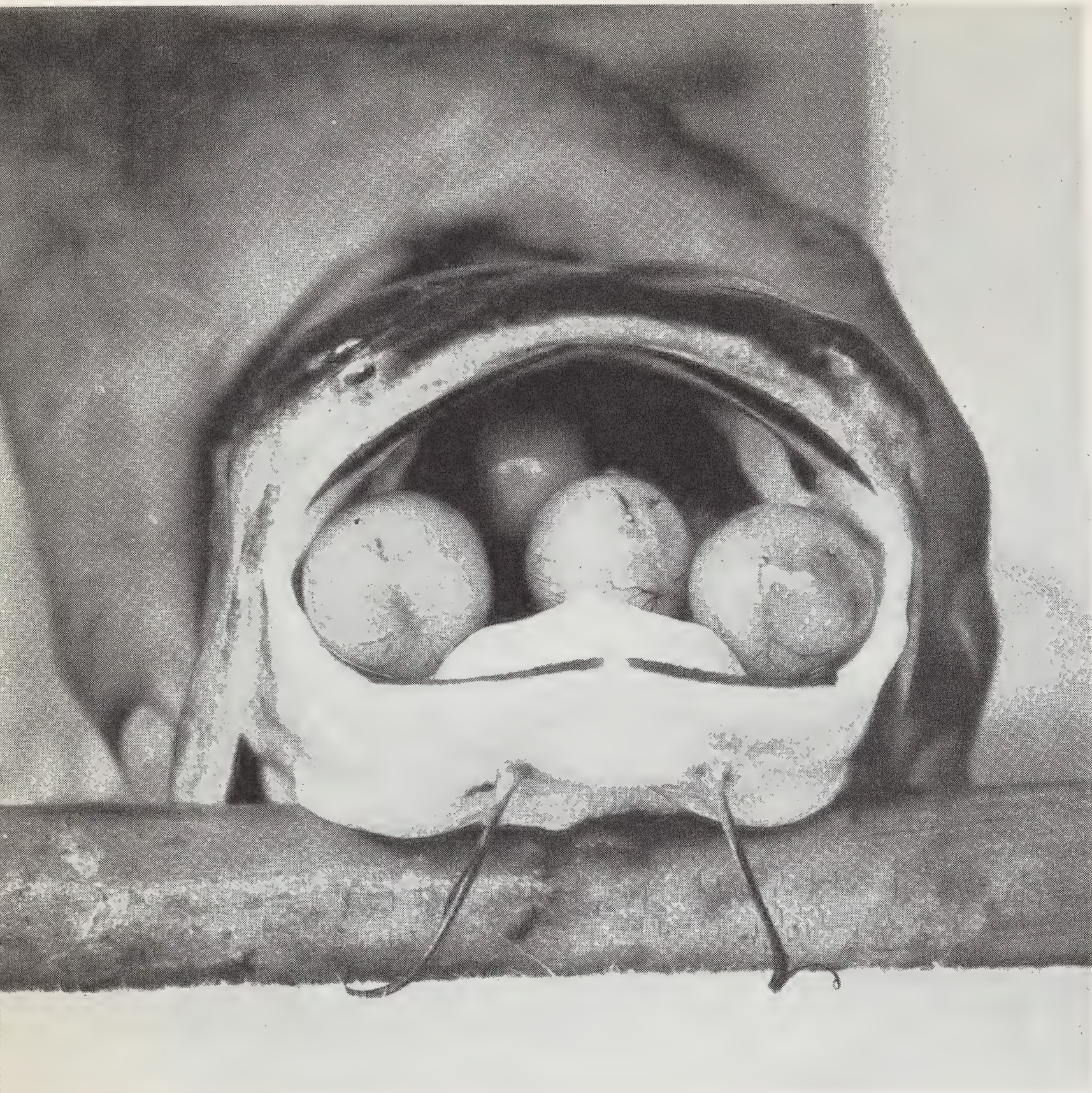
numbers. Where they abound, a crust of bread or even an unappetizing orange peel thrown on the surface will bring up at least a half dozen scrambling fish. In some noisome harbors Sea Catfish may be the only fish present, and they can tolerate widely varying salinities, ranging from full strength sea water to mildly brackish water less than one-sixth as salty. They cannot withstand low temperatures, however, and the occasional cold snaps that occur in Florida and the Gulf states kill many of them.

Although the great majority of the two thousand or more different species of catfish live in fresh water, there is one good-sized Family of them that is mostly marine. It is to this group, the Family Ariidae, that the Sea Catfish belong. Despite their unusual habitat, not even a tyro could fail to recognize them for what they are. Their scaleless bodies, flattened heads, large mouths and, most of all, their well-developed "whiskers," proclaim them catfishes. We have noticed that many visitors to the Aquarium look into the Sea Catfish tank and exclaim, "Oh, look, catfish!" No need for a label here except to provide such information as scientific name, geographic range and maximum size.

Our specimens arrived two days before Christmas last year. Although their tender skins showed abrasions and bruises, the result of a long truck ride from Florida, they healed rapidly, and 11 of the original 13 specimens are still alive and thriving. Their sleek, silvery-gray skins show not a sign of previous injury. Unlike all the many freshwater catfishes we have exhibited at one time or another — which spent most of their time resting immobile on the bottom or hovering quietly in mid-water — our Sea Catfish are constantly on the move. They continuously circle about near the bottom at the center of their tank. More often than not, most of them are going in the same direction, and we believe that they would form a typical school if placed in an extremely large tank. They are not at all particular about their food and will avidly devour almost anything dropped into their tank. We feed them mostly on fresh raw fish and clams. In the wild, the catholic nature of their taste is reflected in the large variety of foods they eat. Fish and shellfish of all sorts, worms, sea-cucumbers and algae have all been found in their stomachs. They are not adverse to eating garbage or offal. In some places, however, they consume almost nothing but crabs and shrimp.

The Sea Catfish is too small to make it a first-class food fish. It is seldom fished commercially; in fact, in some places fishermen consider it a pest, undoubtedly because large numbers become fouled in their nets. They are troublesome to remove because of the three venomous stings in the dorsal and pectoral fins. These sharp, serrated spines are closely associated with poison glands and can produce painful and slow-healing wounds. During both World Wars, however, the Sea Catfish was used for food. Like most catfishes, it has tasty, white, bone-free flesh which prejudice alone relegates to the position of an inferior foodstuff. Its larger relative living in the same areas, the Gafftopsail Catfish, forms a small part of the commercial catch of the Carolinas, Florida and the Gulf states. In tropical Asia and Africa, however, the marine catfishes are an important food.

Last June we noticed that three of the six Sea Catfish then on exhibition had begun to show a peculiar enlargement of their ventral fins — the paired fins that correspond to the hind legs of a terrestrial, four-footed animal. Along the inner



The eggs being incubated inside the mouth of this male Gafftopsail Catfish are three-quarters of an inch in diameter. As many as 55 eggs have been found in the mouth of a brooding fish.

Both photographs from E. W. Gudger

Young Gafftopsail Catfish removed from their father's mouth while still carrying large yolk sacs attached to their bellies. By the time these are absorbed the fish will be 4 inches long

margin of each fin, a thickened, triangular, hook-like flap had developed, and as time went on these protuberances became more and more prominent. Their reddish coloration showed them to be engorged with blood, another indication of rapid growth. Studies on wild Sea Catfish, in which specimens were collected every week or so during the year, showed that these enlargements appear only in females in which eggs are ripening and that after the eggs are laid they recede and eventually disappear. On the Florida, Louisiana and Texas coasts, spawning was found to occur during June and the first half of July. We soon noted that the bellies of our females had become decidedly rounder. It certainly looked as if the fish were getting ready to spawn — and on time, too.

This was exciting, not only because marine fishes so seldom reproduce in captivity that breeding any of them is noteworthy, but also because of the extraordinary reproductive behavior of the Sea Catfish and its relatives. For a century it has been known that at least some of the marine cat-

fishes incubate their eggs and young in their mouths. Earlier reports described how the young sought shelter in the *mother's* mouth, it being assumed that any parental care must be associated with the female sex. Other early observers interpreted the expulsion of young from the supposed female's mouth as an indication of viviparity. We now know it is the male, not the female, that exercises parental care. Mouthbreeding male catfish belonging to not less than 40 different species have been collected, all of them members of the Family Ariidae. (A single female has been recorded among 249 egg-carrying individuals of a Philippine species). Fishermen and zoologists have caught them along the shores of all the continents except Europe and around such islands as Ceylon, New Guinea, the Philippines and the East Indies. The Giant Salmon Catfish of Australia, which attains a length of three feet and weight of 60 pounds, and one Guianan species that gets almost half again as large, are known to be oral incubators, as well as small species like the Sea Catfish, males of which may

be only six inches long by the time they are carrying broods. A few ariid catfishes have returned to their ancestral fresh waters and live and reproduce there. Their reproduction has not changed and they, too, are oral incubators.

Associated with the habit of mouthbreeding are the tremendous eggs of these fish. They are by far the largest eggs of any bony fish and range in diameter from one-half to nearly seven-eighths of an inch. Those of the Sea Catfish sometimes have a diameter of three-quarters of an inch, but on the average they are slightly smaller. The eggs of most bony fishes are less than an eighth of an inch in diameter; marine catfish eggs are thus provided with more than two hundred times as much yolk. It takes the embryonic catfish a long time to utilize all this nourishment. In the case of the Sea Catfish, the supply lasts perhaps six weeks, until the fish is nearly two inches long.



In some of the other marine catfishes, the young are four inches long by the time all their yolk is absorbed. Although young Sea Catfish grow only another three-sixteenths of an inch before they are freed from all parental care, examination of their stomachs has shown that they feed while still being sheltered in their father's mouth. Whether they do this while inside by sifting tiny floating animals and plants out of the stream of water that their father constantly draws over them, or whether they leave their refuge to forage about, returning if danger threatens or to bed down and rest, is not known. No trained observer has ever been able to study live egg-carrying catfish under the kind of undisturbed

conditions necessary before any fish would allow its young to leave the mouth to feed — as some of the other kinds of orally-incubating fishes are known to do.¹

By the time the young marine catfish is on its own it may be four inches long — a giant compared with the minuscule fry of the great majority of egg-laying fishes. It is in every way a miniature of its parents, fully equipped to make its way in the world.

Throughout the animal kingdom, the number of young produced by a species is inversely proportional to the amount of parental care it exercises. This compensation is one of nature's ways of regulating the numbers of animals, and it holds for fishes very well. For example, the Cod, which lays its floating eggs broadcast, produces hundreds of thousands, even millions of them, while a brood of one hundred is unusually large for the live-bearing Guppy. A female Sea Catfish produces perhaps fifty eggs during a season, depending on her size, of course. Since the greatest number of eggs that has ever been found in a brooding male's mouth is 48, and the average is less than half that many, it is clear that each female usually spawns with more than one male during the course of a season. (In two other species of marine catfishes, averages of 25-35 and 30-40 eggs *per* mouthbreeding male have been recorded). The largest number of eggs or young ever taken from the mouth of any marine catfish is 55 — from a 22-inch Gafftopsail Catfish (*Bagre marinus*) of North Carolina.

In some places enough egg-carrying male marine catfishes are caught to make their eggs an article of commerce. In Thailand, for instance, they are marketed separately, while the great Kanduli fishery of Laguna de Bay, Luzon (the largest freshwater lake in the Philippines), yields hundreds of pounds of valuable catfish eggs which are taken from brooding males during the spawning season.

The most amazing feature of oral incubation in the marine catfishes is the length of time that they carry their offspring. Students agree that it takes about a month for the young Sea Catfish to hatch and that the young are brooded for an additional two to four weeks. Estimates for other species are very similar. During this entire pe-

¹ See "The Peregrinating Tilapia" by the same author in *ANIMAL KINGDOM*, Vol. 57, pages 148-155, October, 1955.

riod of six to nine weeks, the male appears to eat nothing; when examined, the digestive tracts of almost all incubating males have proved to be entirely empty. Occasionally some unidentified greenish or yellowish material was present in the stomach. Perhaps this is the basis for the as yet unsubstantiated claim that the female produces extra yolk material that serves as food for the male during incubation. What prevents the starving father from making a meal of his offspring is a mystery — especially since female Sea Catfish and non-brooding males have been found with partially digested eggs or young, of their own species or of other marine catfishes.

Much has been learned about reproduction in these strange fishes, but no one has yet been able to give an eyewitness account of the actual spawning. How does the male get the eggs into his mouth? What is the function of those peculiar flaps that develop on the ventral fins of ripe females? All of the marine catfishes seem to have kept these intimate details of their lives hidden from prying ichthyologists and professional naturalists. One reason is probably that spawning takes place during darkness. Another is that the waters inhabited by the fish are frequently so roiled that any observation is impossible, day or night.

What excited us most about the incipient breeding of our Sea Catfish was the prospect of witnessing their spawning. For several weeks we peered into their tank hopefully every time we passed by. The first thing we did when we entered the place in the morning was to go to the Sea Catfish tank, and we checked it the last thing each night. We enlisted the aid of fellow staff members and the tankmen who took care of the fish. But all our watching was to no avail; the fish spawned without being seen. For four to five days the throat of one of the males looked swollen. Then the swelling disappeared and about two dozen frail, milky objects that could only be egg “shells” floated around the tank. Just what happened is not easy to say. Why were not the eggs swallowed, covering and all, if they *were* eaten? And if they were not eaten, what *did* happen to them? Perhaps they were spit out by the male and then eaten piecemeal by the other fishes in the tank. Our confusion

was not helped when, a couple of weeks later, some more egg “shells” made their appearance.

Ichthyologists have suggested more than one way that spawning could take place among the marine catfishes. One of them believed that the eggs were laid in a depression in the sand and were then picked up and orally incubated. Since the author gave no evidence to support his view, since marine catfishes frequently inhabit areas where such nests could not be made, and since this account ignores the flaps or pads on the female’s ventral fins — which must be present for *some* reason — we can consider it only a possibility, even though it is the method employed by several other kinds of mouthbreeding fishes. Most investigators agree that the ventral flaps or pads would make it easy for the female to carry or hold her eggs, either in a grape-like bunch or one at a time, until the male fertilizes them and takes them into his mouth. No nest would be necessary, and the large eggs, which are heavier than the saltiest sea water, would not sink into the thick layer of mud or marl that covers the bottom where many marine catfishes live. One Philippine observer has described how ripe females that were being brought to the surface in a large net, laid their eggs and momentarily held them in their ventral fins before dropping them. Some species of marine catfishes, however, do not develop flaps or pads. Nevertheless, they may be able to do the same thing as those species possessing them. The females of all species of marine catfishes have larger, somewhat differently shaped ventral fins, than the males, regardless of whether they ever develop accessory structures. Perhaps they use these fins to hold the eggs in the way a distantly related group of catfishes does, that is, like a ping-pong ball held between two paddles.

Whatever the spawning behavior of the Sea Catfish and its relatives, it is sure to be unique. On the day before our fish spawned, we noted that instead of the males desultorily chasing the females, as had been going on for some time, the females now and then rather vigorously chased the males. Next June or July, we shall be looking for this telltale (we hope) behavior. When we see it, we intend to spend a long time in front of our tank of Sea Catfish.

News from the Conservation Foundation

Fire Ant Study

A study entitled "The Program to Eradicate the Imported Fire Ant — Preliminary Observations," is being distributed. This study was made by Dr. John L. George, now with the U. S. Fish and Wildlife Service. Conclusions of the study recommend that a clearly-defined need be demonstrated for the use of pesticides against an insect pest, rather than their use as a matter of course. The report concludes: "The use of pesticides presents a most serious challenge in view of the truly tremendous increase in use in the last decade, the highly toxic character of many of these, and possible cumulative effects at sublethal levels."

Alaska Survey

In September, Research Associate Richard O. Cooley made a short trip to Alaska to assess natural resource problems in relation to the impending statehood of Alaska. Through his wide acquaintance, gained in five years in the Territory, Mr. Cooley developed several possible methods whereby the Foundation might cooperate with Alaskan agencies in research projects relating to utilization of resources in the new State.

Advisory Council Meeting

Early in October the Foundation staff met with Firman E. Bear of Rutgers University, Stanley A. Cain of the University of Michigan, Caryl P. Haskins of the Carnegie Institution of Washington, Carl O. Sauer of the University of California and Paul B. Sears of Yale University, all members of our Advisory Council. The meeting reviewed current educational and research projects and considered future activities in which the Foundation might make significant contributions.

I.U.C.N. Meeting

The Zoological Society and the Conservation Foundation were represented at the 7th Technical Meeting of the International Union for the Conservation of Nature in Athens by Dr. Edward H.

Graham of the Soil Conservation Service. Harold J. Coolidge of the National Research Council, a member of the Foundation's Advisory Council, also attended. Noel Simon, the chairman of the Kenya Wild Life Society, with whom we have worked on the preservation of African fauna, was given assistance to enable him to attend the meeting also.

Film Strip Preview

Our Audio-visual Department, in collaboration with IMPCO, Inc., has completed three series of three film strips each for elementary, junior high and high school use. These films develop the concept of supply and demand and man's interdependence with his environment. A preview of the strips was held at the Johnny Victor theatre, which was made available to us by the Radio Corporation of America, for a group of educators, journalists and businessmen. The strips and a teacher-guide will be available to schools throughout the country.

Conservation Achievement Test

A test to appraise student awareness of conservation problems and concepts has been developed by the Educational Testing Service of Princeton, N. J. About a thousand 9th and 10th grade pupils are now taking the experimental form of the test and after review it will be widely used. Eventually the results will form a basis for further work in developing sounder approaches to conservation education.

Resource Training Meeting

The Natural Resources Study Committee, the University of California at Berkeley and the Conservation Foundation organized a meeting at Berkeley on November 3-5 to compare graduate and undergraduate conservation programs and research and training in natural resources. Representatives of 20 universities and colleges, several governmental agencies and members of other groups attended. Roger Hale of the Foundation staff organized the meeting.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Joseph A. Davis, Jr., Appointed to Mammal Staff at Zoo

Joseph A. Davis, Jr., was appointed Assistant Curator of Mammals on the staff of the Zoological Park on November 1. He was graduated from Fordham University in 1951 and at present is completing his work for a doctorate in vertebrate zoology at Cornell University.

Mr. Davis was in the Medical Service Corps of the Air Force from 1951 to 1953, was an assistant in the Department of Mammals at the American Museum of Natural History in 1954, and from 1956 to 1958 was a teaching assistant in conservation and biology at Cornell. He has done field work in the western United States and in Mexico.

Platypus Dies of Pneumonia

Patty, the eldest of the three Platypuses which came to us from Australia on June 7, was found dead on the morning of November 8. The apparent cause of death was pneumonia but suspicious lesions on the liver are being studied. She was about 2½ years old.

Her weight had declined from 2.11 pounds on October 2 when Patty, Pamela and Paul were taken into winter quarters from the out-of-doors Platypusary, to 1.67 pounds.

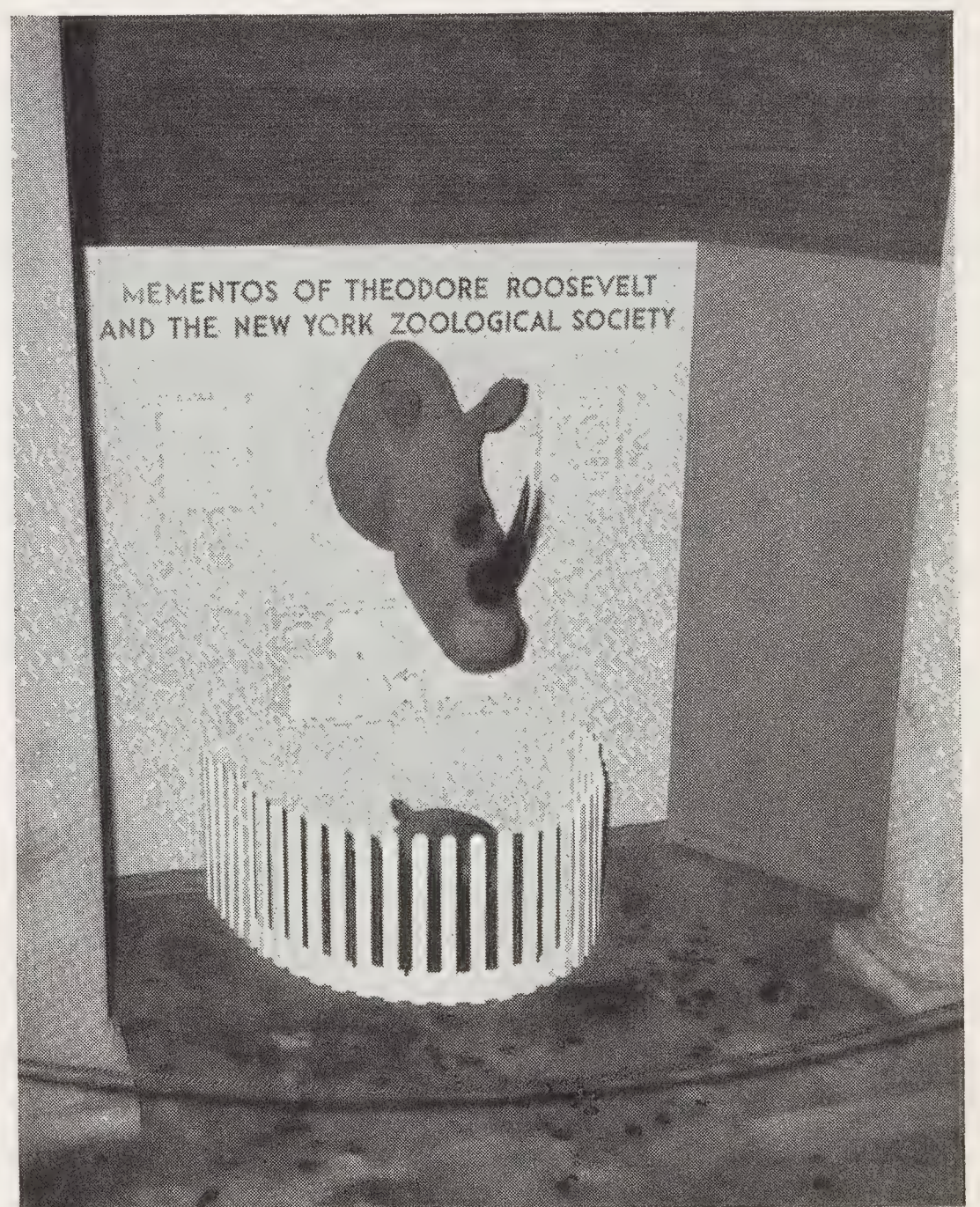
Pamela and Paul, after some erratic feeding behavior, seem to be doing well.

"T.R." Exhibit in the Zoo

In commemoration of Theodore Roosevelt's centenary, the Zoological Park made an exhibition of "T.R." mementos in the Lion House during the week of October 27-November 2.

Mr. Roosevelt was president of the Boone and Crockett Club in 1894 when a group of club members proposed the establishment of the New York Zoological Park, and he appointed the

committee which obtained a charter from the State Legislature. All through the early years of the Society he kept closely in touch with affairs at the Zoological Park.



The exhibit included what is probably the only living souvenir of the President-naturalist — a South American Tortoise, named "Teddy," collected during the Roosevelt expedition to South America in 1913 and presented to the Zoo in 1914. It is today the oldest animal in the collection, after 44 years on exhibition. It was adult when it came.

Also included was the mounted head of a White Rhinoceros shot by Mr. Roosevelt in the Upper Sudan on January 28, 1910, and now in the National Collection of Heads & Horns in the Zoo. A number of letters from Mr. Roosevelt to Dr. William Beebe were also shown.

IN BRIEF

Duck-scarer Needed. There was a time, many years ago, when the staff of the Zoological Park welcomed the autumn influx of wild Canada Geese, Mallards and Black Ducks that settled on our Wildfowl Pond and thrived on the grain we threw out for them. In those days our own collection of ducks was small and the visitors were considered a good show. Now, however, when we try to keep a large and varied collection of pinioned ducks, we are finding it almost impossible to feed them; the visitors come in such numbers and eat so much that our own birds do not get enough to eat. There have already been several losses of valuable waterfowl. As yet we have found no unfailing way of scaring the visitors off or directing them to continue their southward migration.

Elections and Appointments. President Osborn has been elected a Foreign Fellow of the Zoological Society of London . . . Director Coates of the Aquarium was made a Fellow of the Academy of Zoology of Agra, India . . . Dr. Nigrelli, the Aquarium's Pathologist, has been appointed full Adjunct Professor of Biology in the Graduate School of Arts and Sciences of New York University . . . Dr. Myron Gordon, the Aquarium's Geneticist, has been invited by the Hebrew University in Jerusalem to give a series of lectures on fish genetics, and to advise the Israeli government's fish culturists on improvement of their pondfish operations from a genetics viewpoint.

Near Miss in the Penguin House. Try as we — and the penguins — will, we seem unable to hatch an egg in the Penguin House. The King Penguins tried it twice in the past and each time the egg was cracked before hatching. The Humboldts are the latest to try and they brought an egg within a day or two of term, thanks to the rock wall we built about the incubating bird. But at the very end some bumbling bird stepped on the egg and it went the way of the others.

Off to Simla. Dr. William Beebe and the staff of the Department of Tropical Research left on November 7 for the department's field station at Simla, Arima Valley, Trinidad.

Roof Over Their Heads. Re-roofing of the Antelope House required most of the summer and for that period most of the animals were not on exhibition. The roof was completed in October, the antelope collection is again visible, and the job of returning the regular occupants to their stalls was accomplished without incident.

Five Days a Week. Because of the fewness of visitors to Coney Island during the winter months, the Aquarium will be closed on Mondays and Tuesdays, except when holidays fall on those days. The seven-days-a-week schedule will be resumed in the spring.

Benny Is Deposed. When we acquired three young California Sea Lions this fall we were afraid that Benny, an aggressive older Sea Lion, would harass them. On the contrary: the youngsters stick together, "porpoising" and playing constantly, and have thoroughly intimidated Benny.

PUBLICATIONS OF INTEREST

LIVING BIRDS OF THE WORLD. By E. Thomas Gilliard. 400 pp. Many black-and-white and 217 color illus. Doubleday & Company, Inc., Garden City, New York. \$12.50.

Our interest in birds often remains confined to those of our own locale and we lose the perspective and enjoyment which familiarity with their ramifications throughout the world will bring us. "Living Birds" is a remarkably readable and comprehensive review of the avian world backed up by a spectacular group of fine photographs. It is not merely a picture book, but contains more than 200,000 words of fascinating text summarizing an amazing amount of up-to-date life history and structural information. The American naturalist can read how a Barn Owl may capture prey in complete darkness and how Oil Birds find their way in South American caves, or he may compare the surprising habits of our native Cowbirds with the wonderful parasitic practices of European Cuckoos. Elephant Bird eggs and "Thermometer Birds," Puffin life and Tody nests, Hornbills and Jacamars, Honey-guides and Manakins — all are reviewed with discernment, so that exciting features are brought to light.

A few errors in a work of this scope are inevitable, and there are some mistakes in the text and a misidentification or two among the pictures.

Zoological Society members will be pleased to note the many fine photos from the Zoo's collection which have been used. The beautifully reproduced color and black-and-white photographs are a major contribution. Certainly several species have rarely, if ever, been illustrated before, and while many of the photos are of captive specimens, Dr. Gilliard has selected many pictures which are calculated to show something of the bird's life or habits. This book is likely to be the "standard work" for some time to come and will certainly increase the incidence of nomadism among bird enthusiasts. —W. G. C.

A FIELD GUIDE TO REPTILES AND AMPHIBIANS OF EASTERN NORTH AMERICA. By Roger Conant. Illustrated by Isabelle Hunt Conant. Pp. xviii + 366, 62 figs., 40 pls., 248 maps. Houghton Mifflin Company, Boston, 1958. \$3.95.

This is *the* book herpetologists and naturalists interested in amphibians and reptiles have been waiting for. It is here at last — and just in time for the Christmas list of every reader of ANIMAL KINGDOM. One cannot write an objective review of this book without making frequent use of superlatives. In this day of high publication costs even the price deserves a commendable superlative. It is indeed noteworthy that Houghton Mifflin can publish such an excellent and copiously illustrated book — many illustrations in color — for a price under \$4.00.

Roger Conant, Curator of Reptiles and Publicity at the Philadelphia Zoo, and his wife, Isabelle Hunt Conant, former photographer at the same institution, have been working long and diligently on their *Field Guide*. They have experimented and improvised to make the illustrations the best ever produced on any amphibian and reptile fauna. The colored plates were made from black and white photographs hand-colored by Mrs. Conant. The result is an outstanding collection of pictures that make identification of the species and subspecies a simple and pleasant process.

In his text Roger Conant has assembled a vast amount of detailed, often quantitative, data on each form treated. The known geographic distribution of every form east of the 100th meridian is shown on detailed maps, which represent the latest summary of our knowledge of the distribution of these species. There are general introductory sections on collecting, shipping, and keeping

amphibians and reptiles as pets, as well as the snake-bite problem.

This *Field Guide* is the latest of the Peterson series and is the first to be illustrated directly from living specimens. It is a book that will fill many needs and is certainly a *must* item for every field naturalist, as well as anyone with even an incipient interest in herpetology. — J. A. OLIVER

ANIMALS IN INDIA. By Ylla. 35 pp. of text, 24 pp. of color gravure, 68 pp. of monochrome gravure. Harper & Bros., New York, 1958. \$10.00.

This is the book Ylla was working on when she was killed in an accident while photographing a bullock race at a country fair at Bharatpur in the spring of 1955. She was a great animal photographer and it now appears from her diary that is the only text of the book, apart from the not always entirely accurate captions to the pictures, a charmingly observant and vivid writer as well. In 1952 she graduated from Zoo animals to animals in the wild, and "Animals in Africa" was the result. "Animals in India" will have a greater general appeal, for scenes of people-and-animals are included (the gaudily decorated elephants participating in the festival of Dasara, elephants working, the tiger hunt, snake charm-ers, bullock carts gathering for the fair, the final, heart-breaking picture of white bullocks racing — such a scene as she was photographing when she was killed). Much is owed to her friend Luc Bouchage, who has given "Animals in India" a superb design. Everyone who knew Ylla will feel that this is a fitting memorial to her and regret, again, her untimely death. — W. BR.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1958)

Benefactor

Saul Blickman

Associate Founder

Curt H. Reisinger

Supporting

Wiley Blair, Jr.

Frank S. Butterworth, Jr.

Mrs. C. Neuman de Vegvar

Henry S. Glazier, Jr.

Dr. Melville B. Grosvenor

Contributing

Mrs. Nettie Benenson

Mrs. M. E. Borish

Miss Joy Chute

Edwin F. Gamble

Avrom M. Goodman

Lloyd Hamburger

Miss Anne Barbara Hesse

Lester Jones

Dr. Richard C. Karl

Bruce Koloski

George Lande

Mrs. Robert London

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